HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Cowlitz River Type N Coho (Segregated and Integrated)
Species or Hatchery Stock:	Cowlitz River Type-N Coho (*Oncorhynchus kisutch*)
Agency/Operator:	Washington Department of Fish and Wildlife Tacoma Power
Watershed and Region:	Cowlitz River/Lower Columbia
Date Submitted:	
Date Last Updated:	August 29, 2014

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Executive Summary

The Washington Department of Fish and Wildlife is submitting a Hatchery and Genetic Management Plan (HGMP) for the Cowlitz River Type-N (late returning) coho program to the National Marine Fisheries (NMFS) for consultation under Section 10(a)(1)(A) or 4(d) of the Endangered Species Act (ESA). NMFS will use the information in this HGMP to evaluate the hatchery impacts on salmon and steelhead listed under the ESA. The primary goal of an HGMP is to devise biologically-based hatchery management strategies that ensure the conservation and recovery of salmon and steelhead populations. This HGMP focuses on the implementation of hatchery reform actions adopted by the Washington Fish and Wildlife Commission Policy on Hatchery and Fishery Reform C-3619.

The purpose of the program is to produce Cowlitz River Type-N coho for sustainable escapement to the watershed, while providing recreational harvest under mark-selective fisheries. Program fish will be produced at the Cowlitz Salmon Hatchery, located on the Cowlitz River (WRIA 26.0002). The program will annually release 2,178,000 yearlings to the Cowlitz River. In addition, this program provides eyed-eggs and juvenile coho to various system Remote Site Incubation (RSI) programs on several tributaries in the Cowlitz Basin. The In-season Implementation Tool (ISIT) is used on an annual basis to monitor the program and compliance with Hatchery Scientific Review Group (HSRG) standards.

This Type-N Coho HGMP is built around the principles and recommendations of the Hatchery Scientific Review Group (HSRG). These principles and recommendations represent the best science available for operating hatchery facilities consistent with the conservation of salmonid species. This facility has both "segregated-type" and "integrated type" programs, as defined by the HSRG. The segregated program has operated since 1998; the integrated program was initiated in 2007. A "segregated" program is one in which only hatchery-origin individuals (identified by the adipose fin-clip, with no coded-wire tags) are used in the hatchery broodstocks. Integration is achieved by using up to 30% of the returning adult natural-origin Type-N coho (distinguished by an intact adipose fin) returning to the Cowlitz River at the Cowlitz Salmon Hatchery trap from September through February. All fish released through this hatchery program have been 100% mass-marked (adipose fin-clipped) since brood year 1995, return year 1998; progeny from the integrated program are also released 100% coded-wire tagged (CWT).

Lower Columbia River coho are listed as "Threatened" under the ESA. The ESU includes the Cowlitz Type-N Coho Program in the Upper and Lower Cowlitz Rivers, as well as the Cowlitz Game and Anglers and Friends of the Cowlitz coho RSI programs.

Broodstock Collection:
The broodstock is derived from stock returning to the Cowlitz sub-basin. The proportion of natural-origin fish in the broodstock (pNOB) for the integrated portion of the program has averaged 91% since 2007. The current egg-take goal is collected from around 1,537 adult pairs, at a 1:1 female:male ratio, with a minimum of 5% of the total spawning population from jack males. All natural-origin adults of upper Cowlitz origin above brood stock needs and up to 25,000 of the F1 progeny from the integrated program above hatchery broodstock needs are transported above Cowlitz Falls Dam to Lake Scanewa, Cispus River or the Cowlitz River at Packwood to enhance spawner distribution and recreational angling opportunity at those locations. Up to 6,000 adults of combined NOR (Tilton origin) and HOR above hatchery broodstock needs are transported to the Tilton River. Approximately 83 pair are used to secure the 40,000 and 230,000 eyed eggs needed for the CG&A and FOC programs, respectively.

Additional HOR adults above broodstock needs may be donated to the food banks and tribes or used for nutrient enhancement. Fish are transported and released by Tacoma Power.

Harvest:
Total annual harvest is dependent on management response to annual abundance in *Pacific Salmon Commission* (PSC - U.S./Canada), *Pacific Fishery Management Council* (PFMC - U.S. ocean), and *Columbia River Compact* forums. WDFW has also received authorization for tributary, Columbia River mainstem, and ocean fisheries; the combined harvest rates in the *Fisheries Management and Evaluation*

Plan (FMEP), *Columbia River Fish Management Plan* (CRFMP), and ocean fisheries are reviewed annually in the North of Falcon process. The *U.S. v Oregon* Technical Advisory Committee (TAC) has prepared Biological Assessments (BAs) for combined fisheries based on relevant *U.S. v Oregon* management plans and agreements. The current BA concerns Columbia River treaty Indian and non-Indian fisheries, as described in the "2008–2017 *U.S. v Oregon* Management Agreement for upriver Chinook, sockeye, steelhead, coho, and white sturgeon" (2008–2017 MA).

Due to limitations that not all fish can be accounted for as being harvested or as back-to-rack counts, smolt-to-adult survival rates (SAR) are likely underestimated. Based on the average SAR of 0.75% for brood years 2000-2009, and a programmed on-station release goal of 2,178,000 yearlings, the estimated production would be 16,335 adults.

Monitoring and Evaluation:
Performance indicators for harvest will be accomplished by continuing mass-marking (adipose fin-clip); CWT recoveries help determine stray rate contributions on spawning grounds by watersheds close in proximity to this program's release vicinity.

In addition, temporary fish collection weirs have been installed, and operated on the lower Cowlitz tributaries since 2012. Operation of these weirs allow WDFW to control the number of hatchery coho reaching natural spawning locations, thereby benefiting natural production in these basins. Additionally, this project funds spawning ground survey activities to monitor the effectiveness of these weirs and allow for the calculation of important hatchery performance metrics, such as pHOS. Deliverables include estimates of pHOS, and trapping efficiency.

Operation and Maintenance of Hatchery Facilities:

WDFW's Cowlitz Type-N coho are produced at the Cowlitz Salmon Hatchery, which draws water from multiple sources: wells with a water right of 4,920 gpm; and an intake on the Cowlitz River, with a water right of 200 cfs. Intake and screen criteria are in compliance with state and federal guidelines (NOAA-NMFS 1995, 1996), but do not meet the current Anadromous Salmonid Passage Facility Design criteria (NOAA-NMFS 2011). Tacoma Power is investigating the intake to see if reasonable measures could result in improvements. The Cowlitz Salmon Hatchery operates under the *"Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System* (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE).

RSI sites have been chosen that provide a consistent source of water with minimal siltation problems. Water intake pipes are screened to prevent debris or fish from entering the incubator. RSIs are checked regularly or more if needed due to significant rain events. Fish produced from these programs are released unfed, and are therefore <20,000 lbs and < 5,000 lbs of fish feed per month; therefore, these programs do not require an NPDES general permit.

1 SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1 Name of hatchery or program.

Cowlitz River Coho (Type-N)

1.2 Species and population (or stock) under propagation, and ESA status.

Cowlitz Salmon Hatchery Coho (*Oncorhynchus kisutch*) - Type N

ESA Status: Listed as threatened on June 28, 2005, under the Lower Columbia River Coho ESU(70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

1.3 Responsible organization and individuals

Hatchery Operations Staff Lead Contact

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Fish Management Staff Lead Contact

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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Tacoma Power:	Funding Source and Cowlitz Salmon Hatchery Facility Owner
Friends of the Cowlitz (FOC):	Co-operative group that operates a project in lower Cowlitz System tributaries
Cowlitz Game and Anglers (CG&A):	Co-operative enhancement group that operates a project in lower Cowlitz tributaries
Kraus/Ryderwood Project:	Co-operative enhancement program

1.4 Funding source, staffing level, and annual hatchery program operational costs.

Funding Sources	Operational Information
Tacoma Power	Full time equivalent staff – 12.7
	Annual operating cost (dollars) - $2,656,072

The above information for full-time equivalent staff and annual operating cost applies to all species propagated at this facility.

1.5 Location(s) of hatchery and associated facilities.

Broodstock Source: Cowlitz Salmon Hatchery coho Type-N stock

Table 1.5.1: Location of culturing phases, by facility.

Facility	Culturing Phase	Location
Cowlitz Salmon Hatchery	Broodstock collection, adult holding/spawning, incubation, rearing, acclimation.	Located on the Cowlitz River (WRIA 26.0002) at RKm 79.0, tributary to the Columbia River at RKm 109.4 Lower Columbia River, Washington.

In addition, this program provides eyed-eggs and juvenile coho to various system Remote Site Incubation (RSI) programs on several tributaries in the Cowlitz Basin. The program also provides sub-yearlings to the Kraus Ryderwood project on Campbell Creek, and eyed-eggs to numerous Region 5 school aquarium projects (see HGMP section 1.11.2).

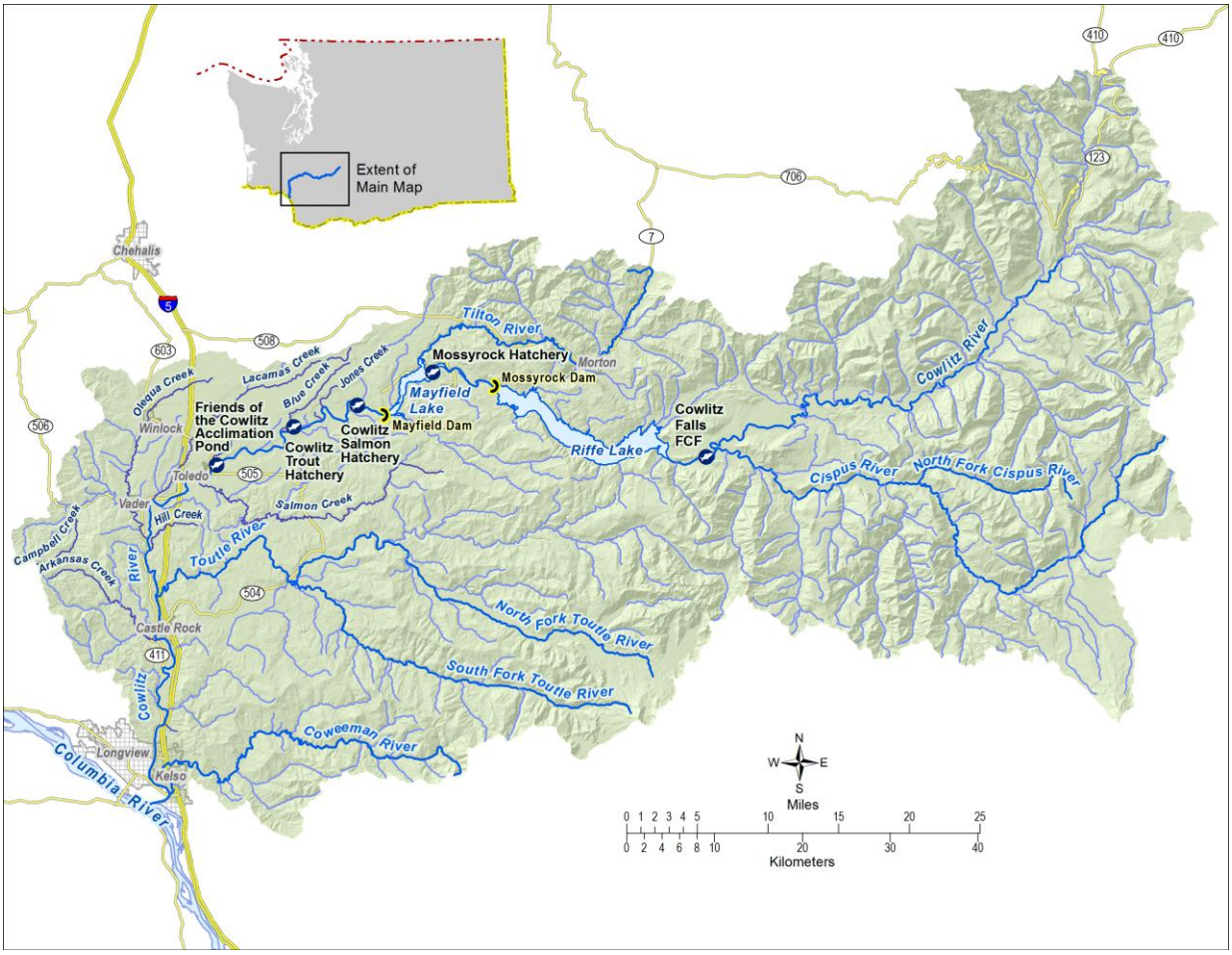

Figure 1.5.1: Map of Cowlitz Salmon Trout Hatchery Facilities and Cowlitz Falls Fish Collection Facility. Source: WDFW GIS 2014.

1.6 Type of program.

Segregated Harvest

Integrated Harvest

1.7 Purpose (Goal) of program.

Mitigation/Augmentation. The goal of this program had been to mitigate for the loss of coho due to Cowlitz River Hydroelectric Project in the basin by achieving an adult goal back to the facility. Under the new Federal Energy Regulatory Commission (FERC) license, the primary objective of the new Cowlitz River Hydroelectric Project Settlement Agreement is ecosystem integrity and the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted

stocks, to harvestable levels (FERC No. 2016, August 2000). In order to achieve these goals and objectives reintroduction of Chinook, coho, steelhead above Mayfield Dam, and cutthroat into the upper Cowlitz River above Lake Scanewa and Tilton River (Mayfield Lake) basins will occur. In addition, habitat improvements are planned to increase fish passage/collection facilities at key locations in the Cowlitz River Basin to increase fish survival through the Project area. The harvest goal for this program is 20,000 to 30,000 fish in the lower Cowlitz per the *Fisheries and Hatchery Management Plan* (FHMP update 2011).

1.8 Justification for the program.

Coho were historically abundant in the sub-basin. The construction of Mayfield and Mossyrock Dams blocked access to much of the historical spawning habitat (Myers et al. 2003).

By the late-1990s, most indigenous anadromous populations in the lower Columbia ESU, including the Cowlitz River system, were either depressed, proposed for, candidate species or listed under the Endangered Species Act (ESA). The new Cowlitz River Hydroelectric Project Settlement Agreement (SA) has prioritized restoring ecosystem integrity with the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels (The Cowlitz River Project, FERC No. 2016, August 2000). The Cowlitz River Fisheries and Hatchery Management Plan (FHMP update 2011) proposes hatchery operations which will rear salmonids native to the Cowlitz River as integrated programs, and all non-native species as segregated programs.

The Washington Department of Fish and Wildlife supports the use of unfed fry programs from on-site eyed-egg incubation units ("Remote Site Incubators" or RSIs) in certain areas and under certain specific conditions. A *WDFW Cooperative Fish and Wildlife Project Memorandum of Understanding Fish Production Agreement* is used for monitoring Statewide cooperative programs (see HGMP section 3.2). These projects are part of overall watershed restoration efforts in many of the tributaries RSI projects are located on. RSI programs are also described in Washington State Legislative code: RCW 77.95.200 "Remote Site Incubator Program" (formerly RCW 75.50.190) where the goal is to assist the re-establishment of natural salmon and trout populations (see HGMP section 3.2).

Friends of the Cowlitz (FOC) is a 501(c)3 non-profit citizen organization that began in 1988, dedicated to work to restore the runs of salmon, steelhead and cutthroat trout in the Cowlitz River and its tributaries. Landowners, sports fisherman and other interested parties have worked on the fish and wildlife projects for benefit in the Cowlitz River and several major tributaries. FOC has worked successfully with the Washington Department of Fish and Wildlife, Lewis County PUD and BPA, taken a proactive role in Tacoma Power re-licensing of Mayfield and Mossyrock Dams, and participated in the initial Conservation Caucus. The Conservation Caucus was a strong advocate for volitional passage, habitat improvements and improved hatchery practices.

The Cowlitz Game and Anglers (CG&A) is a 501(c)-3 non-profit organization which began in 1939. It is one of the first and longest running citizen groups that organized to partner with local, state and federal governments to help the natural resources in the state (pers. comm. Edwina Herkle 2004). Landowners, sports fisherman and other interested parties have worked on the fish and wildlife projects for benefit in the Cowlitz, South Fork Toutle and Coweeman Rivers.

The primary focus of anadromous salmonid fisheries in the lower Columbia River is harvest of known hatchery-origin steelhead, and spring and fall Chinook, coho, and sea-run cutthroat.

To minimize impact on listed fish by the Cowlitz River coho programs and operations, the following risk aversions are included in this HGMP (**Table 1.8.1**).

Table 1.8.1: Summary of risk aversion measures for the Cowlitz River Type-N coho program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	*Cowlitz Salmon Hatchery*: Water rights are formalized through trust water rights from the Department of Ecology. Monitoring and measurement of water usage is reported in monthly NPDES reports.
Intake Screening	4.2	*Cowlitz Salmon Hatchery*: Intake and screen criteria are in compliance with state and federal guidelines (NOAA-NMFS 1995, 1996), but do not meet the current *Anadromous Salmonid Passage Facility Design* criteria (NOAA-NMFS 2011). *FOC and CG&A RSI projects*: These are short-term rearing projects, which release unfed fry into various tributaries. The water intakes to the RSI units are screened to keep debris or listed fish from entering the unit.
Effluent Discharge	4.2	*Cowlitz Salmon Hatchery*: This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) administered by the Washington Department of Ecology (DOE) WAG 13-1021. *FOC and CG&A RSI projects*: Production stays under NPDES guidelines for permitting, and meets guidelines which do not require the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit (>20,000 lbs total on site production and > 5,000 lbs of fish feed per month).
Broodstock Collection & Adult Passage	7.9	The Cowlitz Salmon Hatchery follows WDFW broodstock collection and sorting protocols; any non-target listed fish can be quickly identified and, if encountered, are released back to the stream to minimize impacts. *FOC and CG&A RSI projects* do not collect broodstock.
Disease Transmission	2.2.3, 7.9, 10.11	The *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006) and the *Fish Health Policy in the Columbia Basin* details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Health Policy Chapter 5, IHOT 1995).
Competition & Predation	2.2.3, 10.11	Fish are released as smolted yearlings that emigrate from the system and Columbia river within the year of release. Current risk aversions and future considerations are being reviewed and evaluated for further minimizing impacts to listed fish.

1.9 List of program "Performance Standards".

See HGMP Section 1.10. Performance Standards below only pertain to the hatchery production at Cowlitz Salmon Hatchery only and do not contain complete indicators for the upriver reintroduction program. For further information on upriver performance indicators and standards, refer to the Final Draft FHMP (update 2011).

1.10 List of program "Performance Indicators", designated by "benefits" and "risks."

1.10.1 "Performance Indicators" addressing benefits.

Table 1.10.1.1: "Performance Indicators" addressing benefits.

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.2 Program contributes to mitigation requirements. Program provides mitigation for lost fish production due to development within the Columbia River Basin and contributes to sport and commercial fisheries (Columbia River Fish Management Plan, *U.S. v Oregon*).	Number of fish released by program returning, or caught, as applicable to given mitigation requirements.	Annually estimate survival and contribution to fisheries for each brood year released. Production releases are consistent with FTC and FHMP goals. This program provides mitigation for lost fish production due to development within the Cowlitz system; contributes to estuary sport and commercial, and lower Cowlitz river sport fisheries, and supports Upper Cowlitz basin restoration and recovery.
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP updated and re-submitted to NOAA with significant changes or under permit agreement. Enhancement co-op submits yearly WDFW Volunteer Fish Production Release and Planting Record Form that includes details on number of fish, date and location of releases that are reported in WDFW Hatcheries Headquarters Database.
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding overharvest of non-target species.	Annual number of fish produced by program caught in all fisheries, including estimates of fish released.	Annually mass-mark hatchery coho releases to differentiate hatchery from natural-origin fish and record estimates of mark rate. The external mark enables mark-selective fisheries, which can reduce directed harvest mortality on natural-origin fish. Agencies monitor harvests and hatchery returns to provide up-to-date information. Estimate survival and contribution to fisheries for each brood year released.
3.3.1. Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.	Annual number of naturally-produced adults or redds on the spawning grounds or selected natural production index areas.	Annually monitor and report returns to the hatchery and spawning grounds. Enhancement co-ops submit an MOU to WDFW for each year involved in the project.

3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population.	Number of marks released and estimated proportion of marks in out-migrant juveniles and returning adults. Percentage of total hatchery releases mass-marked (fin clips, otoliths, tags, etc., depending on species) to allow for their differentiation from naturally-produced fish as returning adults.	Annually monitor and report size, number, date of release and mass-mark quality (adipose fin-clip rate) of all on-station hatchery releases. RSI groups are released as unfed fry, and are unmarked. Annually sample returning fish for the adipose fin-clip in fisheries and at the hatchery; record numbers of estimated hatchery (marked) and natural (unmarked) fish. Integrated coho are ad & cwt marked.
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	Temporal distribution of broodstock collection at point of collection.	Collect broodstock representatively and systematically throughout the return. Collect annual run timing, age and sex composition and spawning escapement timing data. Adhere to WDFW spawning guidelines (Seidel 1983; HSRG 2009).
3.5.5 Juveniles are released at fully-smolted stage to benefit juvenile to adult survival rates, and reduce the likelihood for residualism and negative ecological interactions with natural-origin fish.	Smoltification and behavior are monitored in the hatchery.	Monitor fish condition in the hatchery throughout all rearing stages. Annually monitor and record size, number, and date of release.
3.5.6 The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Program is sized appropriately for conservation goals.	Monitor harvests and hatchery returns throughout the run.
3.6.1 The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation.	Apply minimal monitoring standards in the hatchery: food conversion rates, growth trajectories, mark/tag rate error, weight distribution (CV).	Collect annual run timing, age and sex composition data upon adult return. Annually record growth rates, mark rate and size at release and release dates. Adhere to HSRG (2009) and WDFW spawning guidelines (Seidel 1983). Enhancement co-ops submit yearly WDFW Volunteer Fish Production Release and Planting Record Form that includes details on number of fish, date and location of releases, reported in the Hatcheries Headquarters Database. See also HGMP section 11 for

		program monitoring and evaluation.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Program is designed to help achieve the end goal of conserving and stabilizing natural salmon populations.	Long-term monitoring of system population will indicate success of program.
	Provide information about agency programs and hatchery operations to such internal and external audiences as local schools and special interest groups. Off station efforts may include festivals, classroom participation, stream adoptions and fairs.	Record on-station organized education and outreach events. Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program.
	Partnerships and education with local government and citizens. Volunteer groups coordinate on-going and future co-operative enhancement projects.	WDFW and the enhancement co-op annually tracks and reports volunteer involvement and total hours committed.

1.10.2 "Performance Indicators" addressing risks.

Table 1.10.2.1: "Performance indicators" addressing risks.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.3 Program addresses ESA responsibilities	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP is updated to reflect any major changes in program and resubmitted to NOAA fisheries. Program risks have been addressed in this HGMP through best available science hatchery management actions. WDFW staff annually reviews Future Brood Document (FBD) for stock, size, number, date and location of releases from all production programs. Monitor and record juvenile hatchery fish size, number, date of release and mass-mark quality; monitor contribution of hatchery adult fish to fisheries and escapement.
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while adequately minimizing by-catch of non-target species.	Number of marks released and estimated proportion of marks in out-migrant juveniles and returning adults on the spawning ground. Production fish are mass-marked (adipose fin-clip) to allow for their differentiation from naturally-produced fish	Monitor and record juvenile hatchery fish size, number, date of release and mass-mark quality; monitor contribution of hatchery adult fish to fisheries and escapement. Harvest is regulated to meet appropriate biological assessment criteria. Agencies monitor harvests and

		hatchery escapements to provide up-to-date information.
3.2.2 Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	Percentage of total hatchery releases are identifiable as hatchery-origin fish. Mass-mark (adipose-fin clip, CWT, otolith-mark, etc., depending on species) produced fish to allow for their differentiation from naturally produced fish for selective fisheries.	Annually monitor and report mass-mark type, quality and rates. RSI groups are released as unmarked unfed fry. Assess annual harvest of mass-marked hatchery fish based on CWT recovery estimates and creel surveys (see HGMP section 3.3.1).
3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production and to evaluate effects of the program on the local natural population.	All hatchery production is identifiable in some manner (fin-marks, tags, otolith, etc.) consistent with information needs.	Annually monitor and record size, number, date of release and mass-mark quality (adipose fin-clip rate) of on-station hatchery releases (RSI groups are released as unmarked unfed fry). Examine returning fish encountered for the mass-mark (CWT) at the hatchery and on the spawning grounds. Annually record numbers of estimated hatchery (marked) and natural (unmarked). See HGMP section 11. This program was modelled to meet HSRG standards for pHOS using the ISIT tool. Program is reviewed annually.
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	Temporal and age distribution of broodstock collected, compared to that of naturally-produced population at collection point.	Collect annual run timing, age and sex composition and return timing data.
3.4.2 Broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.	Number of spawners of natural-origin removed for broodstock.	Trap is checked daily. Non-target listed fish, when encountered, are returned to the river.
3.5.1 Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	Within and between populations, genetic structure is not affected by artificial production.	Not currently monitored.
3.5.2 Collection of broodstock does not adversely impact the genetic diversity of the naturally-spawning population.	Total number of natural-origin spawners (if any) reaching the collection facility. Timing of collection compared to overall run timing.	All on-station hatchery releases are identifiable in some manner (fin-marks, tags, etc.). RSI groups are released as unmarked unfed fry. Collect annual run timing, origin, and age and sex composition data.

		Examine returning fish for the mass-mark (adipose fin-clip) at broodstock collection points and on the spawning grounds. Annually record and report numbers of estimated hatchery (marked) and natural (unmarked).
3.5.4 Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Location of release (on-station, acclimation pond, direct plant). Release type (forced, volitional or direct stream release).	Annually record and report release information, including location, method and age class in hatchery data systems (WDFW Hatcheries Headquarters Database).
3.5.5 Juveniles are released at fully-smolted stage.	Level of smoltification at release. Release type (forced, volitional or direct).	Annually monitor and record size, number, date of release and release type.
3.7.1 Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (IHOT, PNFHPC, *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State*).	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level of compliance with applicable standards and criteria.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed. The program is operated consistent with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). Enhancement co-op coordinators communicate regularly with Region 5 staff. Dead eggs are removed and disposed of properly to prevent incidence of *Saprolegniasis* fungus.
3.7.2 Effluent from hatchery facility will not detrimentally affect natural populations.	Discharge water quality compared to applicable water quality standards by NPDES permit. Washington Department of Ecology (WDOE) water right permit compliance.	Flow and discharge reported in monthly NPDES reports. Enhancement co-ops comply with all permits required and submits MOU to WDFW for each year involved in the project before project is approved.
3.7.3 Water withdrawals and in-stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	Water withdrawals compared to NMFS, USFWS and WDFW applicable passage and screening criteria for juveniles and adults.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
3.7.4 Releases do not introduce pathogens not already existing in	Necropsies of fish to assess health, nutritional status, and	WDFW Fish Health Section inspects adult broodstock yearly

the local populations, and do not significantly increase the levels of existing pathogens. Follow the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, revised 2006).	culture conditions.	for pathogens and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings. RSI project leads and coordinators communicate regularly with Region 5 staff. Dead eggs are removed and disposed of properly to prevent incidence of *Saprolegnia* fungus.
	Release and/or transfer exams for pathogens and parasites.	Examine fish 1 to 6 weeks prior to transfer or release, in accordance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
	Inspection of adult broodstock for pathogens and parasites.	At spawning, all females are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites.	Controls of specific fish pathogens through eggs/fish movements are conducted in accordance to the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
3.7.6 Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally-produced population.	Spatial and temporal spawning distribution of natural populations above and below broodstock collection site is currently compared to historic distribution.	Trap is checked daily. Non-target and/or ESA-listed fish, when encountered, are returned to the river.
3.7.7 Weir/trapping operations do not result in significant stress, injury or mortality in natural populations.	Mortality rates in trap. Pre-spawning mortality rates of captured fish in the hatchery and/or after release.	Traps checked daily. Annually record and report abundances and observations of natural-origin fish at hatchery facilities.
3.7.8 Predation by artificially produced fish on naturally – produced fish does not significantly reduce numbers of natural fish.	Hatchery juveniles are raised to smolt-size and released from the hatchery at a time that fosters rapid migration downstream.	Hatchery smolt release size and time are monitored to quantify/minimize predation effects on naturally produced Chinook (Sharpe et al. 2008, Topping and Zimmerman 2011).

3.8.2. Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	Total cost of program operation.	Annually monitor and report feed costs and fish health actions. Enhancement co-ops submit yearly WDFW Volunteer Fish production Project Release and Planting Record Form that includes details success or operational concerns.

1.11 Expected size of program.

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

At the current program size, the number of broodstock collected is up to 1,537 adults at a female (768) to male (767) ratio of 1:1. A minimum of 5% of the total spawning population is made up of jacks (approximately 80).

Approximately 83 pairs are used to secure the 40,000 and 230,000 eyed eggs needed for the CG&A and FOC programs, respectively, based on an average fecundity of 3,800 eggs/female.

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

Table 1.11.2.1: Proposed annual fish release levels (maximum number) by life stage and location, Cowlitz Salmon Hatchery on-station releases.

Age Class	Max. No.	Size (fpp)	Release Date	Location		
				Stream	Major Watershed	Eco-province
Yearlings	1,200,000 (Segregated)	15	May	Cowlitz River	Cowlitz	Lower Columbia
Yearlings	978,000 (Integrated)	15	May	Cowlitz River	Cowlitz	Lower Columbia

Source: Future Brood Document 2014.

In addition, this program provides eyed-eggs and juvenile coho to various system Remote Site Incubation (RSI) programs on several tributaries in the Cowlitz Basin (**Table 1.11.2.2.).**

Table 1.11.2.2: Proposed annual fish release levels (maximum number) by life stage and location, Cowlitz enhancement co-ops.

Program	Age Class	Max. No.	Major Watershed	Eco-province
Friends of the Cowlitz	Unfed fry	230,000	Cowlitz	Lower Columbia
Cowlitz Game and Anglers	Unfed fry	40,000	Cowlitz	Lower Columbia

Source: Future Brood Document 2014.

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Total escapement levels from program inception to 2012 have averaged 30,688 adult. Starting in 1996, available coho adults above broodstock needs were reintroduced into the upper Cowlitz basin. Under the FHMP, up to 25,000 adults from the integrated program and natural-origin fish (NOR) of upper Cowlitz origin will be placed upstream until a trigger of 60% fish passage survival is achieved with current survival under 40%.

Table 1.12.1: Returns of Type-N coho to the Cowlitz Salmon Hatchery 2002 – 2013.

Return Year	Total Returns	Natural-origin Returns	Segregated Program*		Integrated Program		
			Hatchery-origin Returns	Hatchery-origin Spawned	Hatchery-origin Returns[a]	Hatchery-origin Spawned	Natural-origin Spawned
2002	94,387	10,546	83,841	2,718	-	-	-
2003	48,565	9,287	39,278	2,336	-	-	-
2004	54,100	4,939	49,161	2,323	-	-	-
2005	45,047	6,015	39,032	2,299	-	-	-
2006	66,976	5,695	61,281	2,076	-	-	-
2007	47,299	4,315	42,984	1,798	-	-	332
2008	98,947	5,819	93,128	1,101	-	-	552
2009	89,587	6,565	83,022	1,424	-	-	682
2010	87,044	3,681	83,363	620	-	-	570
2011	51,348	10,737	40,610	938	14,233	0	636
2012	19,738	3,760	16,030	847	5,286	0	489
2013	37,290	3,177	34,113	1,419	13,514	407	137
Average	**61,694**	**6,211**	**55,487**	**1,658**	**11,011**	**136**	**485**

Source: WDFW Hatcheries Headquarters Database 2014.

*No natural-origin fish were used as brood stock in the segregated program.

a. Integrated program hatchery returns are F1 generation, identified by adipose clip and CWT.

For SAR calculations see **Table 3.3.1.1**.

FOC and CG&A RSI programs: Program performance for the incubation and operational success of these projects are based on expectations that RSI programs should exceed 90% eyed-egg to swim-up fry success. Smolt productivity or adult contribution from this program are not known because eggs are not otolith-marked nor monitored at this time. However, RSIs in Cedar Creek system (tributary to the Lewis River) are marked, and could provide an idea of contribution rates. Recent WDFW smolt monitoring on indicates that RSI contributions in 2002 had a 0.275% eyed-egg to smolt survival. This results in 1,100 smolts (approximately 2.98% of the captured run) from the 400,000 egg RSI program in that system This data does not include potential contribution from fry or fingerlings that migrated out of the tributaries before or after the sampling period and which may have reared to smolt stage in other areas in the Cowlitz River.

1.13 Date program started (years in operation), or is expected to start.

CSH: This program has been in operation since construction of the hatchery in 1967.

FOC: Friends of the Cowlitz RSI programs started in the mid-1990s.

CG&A: Cowlitz Game and Anglers RSI programs started in the late-1990s.

1.14 Expected duration of program.

Coho production from CSH is part of the continued operation of the Cowlitz River Hydroelectric Project, FERC Project No. 2016, operated under the new license with an effective date of July 18, 2003. The license is for a term of 35 years and expires July 18, 2038. Cooperative enhancement programs should be on-going until monitoring can determine that self-sustaining population densities are achieved, or the programs are re-evaluated by fisheries co-managers in Washington.

1.15 Watersheds targeted by program.

Cowlitz Sub-basin/Lower Columbia Province (WRIA 26.0002).

1.16 Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

1.16.1 Brief Overview of Key Issues

Note: Issues stated below have been addressed in the new FERC Settlement Agreement (The Cowlitz River Project, FERC No. 2016, August 2000).

Issue 1: Since 1967, coho have been released to the Cowlitz River in order to satisfy the mitigation adult goal and also contributed significant harvest benefits to freshwater and limited ocean fisheries. Ocean survival through the 1990s dramatically affected contribution and survival. With increased survival in the late 1990s, juvenile and adult coho were used for upriver reintroduction. The new SA has been agreed upon by the parties to prioritize the continued operation of the hatcheries for the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels.

Issue 2: In the new SA, significant upper river reintroduction and natural production is occurring. Since the mid-1990s, significant restoration activities in the upper basin have taken place including adult re-introduction, fry and fingerling releases and subsequent natural smolt productivity. The greatest obstacle to restoration of upper basin anadromous fish runs is downstream passage of juvenile salmonids (smolts). They must be captured or collected to ensure that they do not residualize in a reservoir or run through a turbine. The Cowlitz Falls Dam (operated by the Lewis County Public Utility District) is the center of efforts to collect downstream migrant salmonids and transport them safely around hazards of reservoirs and dams to the lower river. Juvenile salmonids produced in the Tilton River pass downstream through a fish counting house at Mayfield Dam or turbines.

FOC and CG&A use remote site incubators to seed habitat areas in conjunction with some habitat restoration work in some of the tributaries. This program should be continued until self-sustaining population densities are achieved, but without monitoring and evaluation, it will be difficult to determine when this is achieved. WDFW will review new proposals for RSIs and require that any additional sites or increase in numbers of eggs follow Future Brood Document (FBD) policy review submittal.

1.16.2 Potential Alternatives to the Current Program

Alternative 1: *Rely on natural coho adults to eventually re-colonize the tributaries*. Significant habitat improvements for upstream and downstream have been agreed to in the SA including: Article 1. Downstream Fish Passage: Riffe Lake and Cowlitz Falls Collection and Passage, Article 2. Downstream Fish Passage: Mayfield and Article 3. Upstream Fish Passage: Barrier, Mayfield and Mossyrock. In the meantime, existing hauling of adults and trucking of smolts will continue. A number of issues hinge on the success of fish passage improvements including the full potential of the upper basin production.

Both, current and future lower and upper river production are proposed by the FHMP. The FHMP indicates that as natural production increases, hatchery production would decrease based on credit mechanisms (see section 3.7 FHMP) after the CSH re-build (>2008). Though the Project has inundated miles of river and tributaries, natural production may not totally be able return to pre-project levels. WDFW is committed to improving hatchery production and making it consistent with wild fish restoration in the Cowlitz basin, but modification of hatchery practices or reductions in lower river production must be evaluated.

Alternative 2: *Discontinue the program*. The natural fish will utilize the habitat improvements and the population will increase over time. It is unknown whether the coho returning to these tributaries are anywhere near carrying capacity, but utilization is believed to be very low due to habitat problems in lower Cowlitz River tributaries; these include sedimentation, high water temperatures, low flows, and gravel quality (*Cowlitz River Sub-basin Salmon and Steelhead Production Plan*, September 1, 1990). WDFW does not support this alternative due to the

valuable outreach and community involvement of local citizens involved with salmon recovery efforts.

1.16.3 Potential Reforms and Investments:

Although costly, the development of restoration programs for the Cowlitz River watershed upstream of the Barrier Dam represents a balancing act between competing needs for harvest and stock restoration, the evolving improvement of fish collection and passage for downstream migrants, the restoration of ecological function in the watershed, and host of other inputs currently unknown. The plan used to guide the process will need to be flexible enough to adapt to new information, aggressive enough to achieve success, and well-enough evaluated to guide this and future projects of this type.

The Cowlitz Salmon Hatchery rebuild was completed in 2010. Planning, developing and reviewing alternatives for Cowlitz River fisheries management is currently underway through the Cowlitz Fisheries Technical Committee. The committee is comprised of representatives from WDFW, NOAA fisheries, Tacoma Power, Trout Unlimited, Washington Department of Ecology, US Fish and Wildlife Service, and the Yakama Indian Nation.

2 SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1 List all ESA permits or authorizations in hand for the hatchery program.

None currently. This HGMP is submitted to the NOAA Fisheries for ESA consultation and take prohibition exemption under ESA section 4(d) or 10.

2.2 Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1 Description of NMFS ESA-listed salmonid population(s) affected by the program.

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program.

Lower Columbia River coho (*Oncorhynchus kisutch*). Identified as a candidate species on June 25, 1995 (60FR38011). Listed as threatened on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.

Lower Columbia River Chinook (*Oncorhynchus tshawytscha*). Listed as "threatened" on March 24, 1999 (64FR14308); threatened status reaffirmed on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Lower Columbia River steelhead (*Oncorhynchus mykiss*). Listed as a threatened species on March 19, 1998 (63FR13347); threatened status reaffirmed on January 5, 2006 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Columbia River chum salmon (*Oncorhynchus keta*). Listed as threatened on March 25, 1999 (64FR14507); threatened status reaffirmed on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

2.2.2 Status of NMFS ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

Lower Columbia River Chinook: In Washington, the LCR Chinook ESU includes all naturally spawned Chinook populations from the mouth of the Columbia to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, as well as fifteen artificial propagation programs. Excluded are Upper Columbia River bright hatchery stocks that spawn in the mainstem Columbia River below Bonneville Dam and in other tributaries upstream from the Sandy River to the Hood and White Salmon rivers (NMFS 2014 79FR20802). Spring Chinook were present historically in the Cowlitz, Kalama, Hood, White Salmon and Lewis rivers.

Status: Today only two of 32 historical populations – the North Fork Lewis and Sandy late-fall populations – are considered viable. Most populations (26 out of 32) have a very low probability of persistence over the next 100 years, and some populations are extirpated, or nearly so. Five of the six strata fall significantly short of the Willamette- Lower Columbia Technical Recovery Team (WLC TRT) criteria for viability. One stratum – Cascade late fall – meets the WLC TRT criteria (Dornbush and Sihler 2013). Dam construction eliminated habitat for a number of populations leading to the extirpation of spring Chinook salmon populations in the Upper Cowlitz, Cispus, Tilton, North Fork Lewis , Big White Salmon rivers, and fall Chinook populations in the Upper Cowlitz and Big White Salmon rivers (SHIEER, NMFS 2004). Projects to allow access have been initiated in the Cowlitz and Lewis systems but these are not close to producing self-sustaining populations; Condit Dam on the Big White Salmon River was breached October 26, 2011. Based on the 2010 recovery plan analyses, all of the 14 Tule populations (**Table 2.2.2.1**) are considered very high risk except one that is considered at high risk. The modeling conducted in association with Tule harvest management suggests that three of the populations (Coweeman, Lewis and Washougal) are at a somewhat lower risk (LCFRB 2010).

Table 2.2.2.1: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River Chinook populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast Fall										
Grays/Chinook	Contributing[2]	VL	H	VL	VL[2]	M+	+500%	800	<50	1,000
Eloch/Skam [C]	Primary	VL	H	L	VL[2]	H	+150%	3,000	<50	1,500
Mill/Aber/Germ	Primary[1]	VL	H	L	VL[2]	H	+155%	2,500	50	900
Youngs Bay (OR)	Stabilizing	--[3]	--[3]	--[3]	L	L	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [C]	Contributing[1]	--[3]	--[3]	--[3]	VL	L	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary[1]	--[3]	--[3]	--[3]	L	H	--[3]	--[3]	--[3]	--[3]
Cascade Fall										
Lower Cowlitz [C]	Contributing	VL	H	M	VL[2]	M+	+50%	24,000	500	3,000
Upper Cowlitz	Stabilizing	VL	VL	M	VL	VL	--	28,000	0	--
Toutle[C]	Primary[1]	VL	H	M	VL[2]	H+	+265%	11,000	<50	4,000
Coweeman [G]	Primary	VL	H	H	VL[2]	H+	+80%	3,500	100	900
Kalama	Contributing[2]	VL	H	M	VL[2]	M	+110%	2,700	<50	500
Lewis [G]	Primary	VL	H	H	VL[2]	H+	+280%	2,600	<50	1,500
Salmon	Stabilizing	VL	H	M	VL	VL	--	n/a	<50	--
Washougal	Primary	VL	H	M	VL[2]	H+	+190%	2,600	<50	1,200
Clackamas (OR) [C]	Contributing	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Sandy (OR)	Contributing[1]	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Cascade L Fall										
Lewis NF [C,G]	Primary	VH	H	H	VH[1]	VH	0%	23,000	7,300	7,300
Sandy (OR) [C,G]	Primary	--[3]	--[3]	--[3]	H	VH	--[3]	--[3]	--[3]	--[3]
Cascade Spring										
Upper Cowlitz [C,G]	Primary	VL	L	M	VL[2]	H+	>500%	22,000	300	1,800
Cispus [C,G]	Primary	VL	L	M	VL[2]	H+	>500%	7,800	150	1,800
Tilton	Stabilizing	VL	VL	VL	VL	VL	0%	5,400	<100	--
Toutle	Contributing	VL	H	L	VL	M	>500%	3,100	100	1,100
Kalama	Contributing[2]	VL	H	L	VL	L	>500%	4,900	100	300
Lewis NF [C]	Primary	VL	L	M	VL	H	>500%	15,700	300	1,500
Sandy (OR) [C,G]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Gorge Fall										
L. Gorge (WA/OR)	Contributing	VL	M	L	VL[2]	M	>500%	n/a	<50	1,200
U. Gorge (WA/OR) [C]	Contributing[1]	VL	M	L	VL[2]	M	>500%	n/a	<50	1,200
White Salmon [C]	Contributing	VL	L	L	VL	M	>500%	n/a	<50	500
Hood (OR)	Primary[4]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge Spring										
White Salmon [C]	Contributing	VL	VL	VL	VL	L+	>500%	n/a	<50	500
Hood (OR)	Primary	--[3]	--[3]	--[3]	VL	VH	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.

L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.

[1] Increase relative to interim Plan.

[2] Reduction relative to interim Plan.

[3] Addressed in Oregon Management Unit plan.

[C] Designated as a historical core population by the TRT.

[G] Designated as a historical legacy population by the TRT.

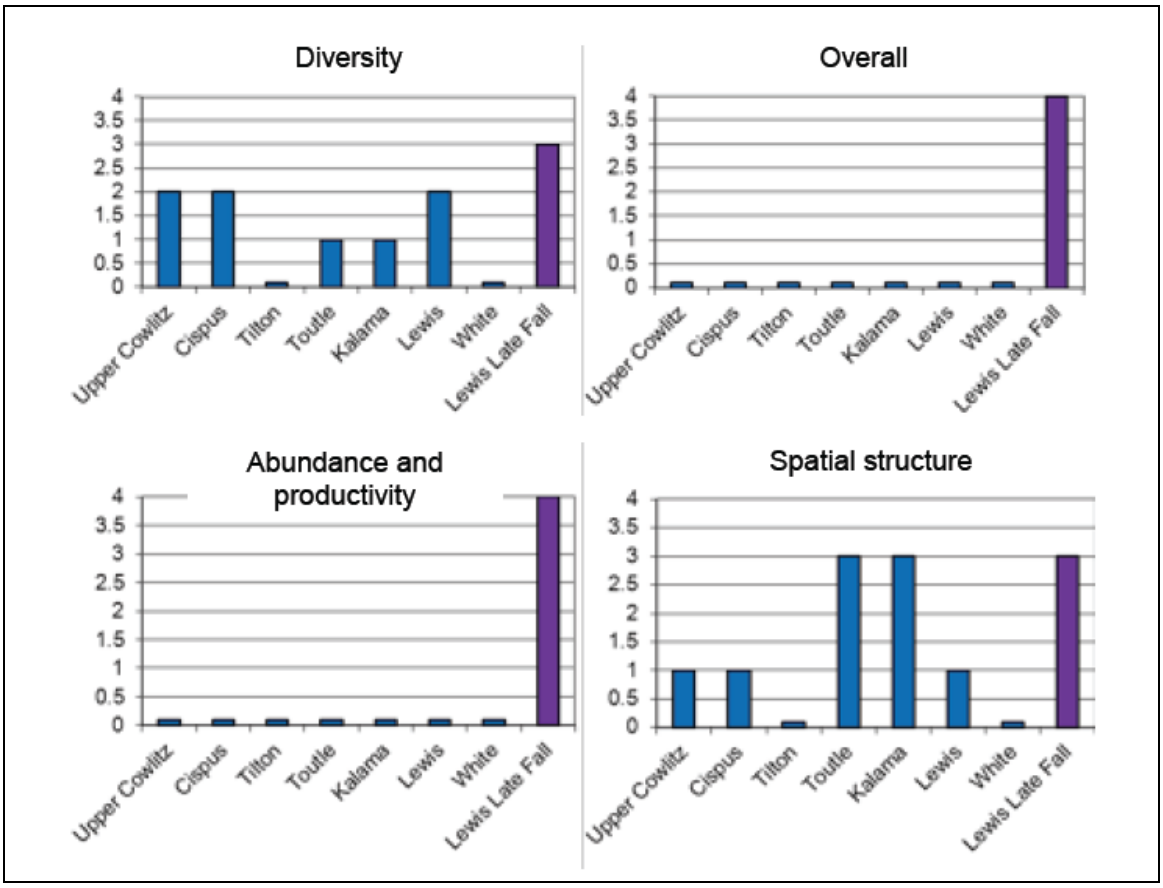

Figure 2.2.2.1: Current status of Washington lower Columbia River spring Chinook and late fall-run (bright) Chinook salmon populations for the VSP parameters and overall population risk. (LCFRB Recovery Plan 2010, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Lower Columbia River Steelhead *(Oncorhynchus mykiss)*: The DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and manmade impassable barriers in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington (inclusive), and the Willamette and Hood Rivers, Oregon (inclusive), and excludes fish originating from the upper Willamette River Basin above Willamette Falls. The DPS includes seven artificial propagation programs, including the Cowlitz Trout Hatchery Winter-late (Lower Cowlitz), Kalama River Wild (winter- and summer-run) and Lewis River Wild Winter (NMFS 2014 79FR20802).

Status: Today, 16 of the 23 Lower Columbia River steelhead populations have a low or very low probability of persisting over the next 100 years, and six populations have a moderate probability of persistence. Only the summer-run Wind population is considered viable. All four strata in the DPS fall short of the WLC TRT criteria for viability (Dornbush and Sihler 2013). Populations in the upper Lewis and Cowlitz watersheds remain cut-off from access to essential spawning habitat by hydroelectric dams. Projects to allow access have been initiated in the Cowlitz and Lewis systems but these have not yet produced self-sustaining populations (Ford 2011). Condit Dam on the White Salmon River was breached October 26, 2011. WDFW is currently developing watershed-specific management plans in accordance with the SSMP. As part of this planning process, WDFW is proposing to complete a thorough review of current steelhead stock status using the most up to date estimates of adult abundance, juvenile production and genetic information.

Table 2.2.2.2: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River steelhead populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast Winter										
Grays/Chinook	Primary	VH	VH	M	M[1]	H	0%[4]	1,600	800	800
Eloch/Skam	Contributing	VH	VH	M	M[1]	M+	0%[4]	1,100	600	600
Mill/Ab/Germ	Primary	H	VH	M	M[1]	H	0%[4]	900	500	500
Youngs Bay (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Big Creek (OR)	Primary	--[3]	--[3]	--[3]	H	VH	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Cascade Winter										
Lower Cowlitz	Contributing	L	M	M	L	M	+5%	1,400	350	400
Upper Cowlitz [C,G]	Primary	VL	M	M	VL[2]	H[1]	>500%	1,400	<50	500
Cispus [C,G]	Primary	VL	M	M	VL[2]	H[1]	>500%	1,500	<50	500
Tilton	Contributing	VL	M	M	VL	L	>500%	1,700	<50	200
S.F. Toutle	Primary	M	VH	H	M	H+	+35%	3,600	350	600
N.F. Toutle [C]	Primary	VL	H	H	VL[2]	H	+125%		120	600
Coweeman	Primary	L	VH	VH	L[2]	H	+25%	900	350	500
Kalama	Primary	L	VH	H	L[2]	H+	+45%	800	300	600
N.F. Lewis [C]	Contributing	VL	M	M	VL[2]	M	>500%	8,300	150	400
E.F. Lewis	Primary	M	VH	M	M[1]	H	+25%	900	350	500
Salmon	Stabilizing	VL	H	M	VL[2]	VL	0%	na	<50	--
Washougal	Contributing	L	VH	M	L[2]	M	+15%	800	300	350
Clackamas (OR) [C]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Sandy (OR) [C]	Primary	--[3]	--[3]	--[3]	L	VH	--[3]	--[3]	--[3]	--[3]
Cascade Summer										
Kalama [C]	Primary	H	VH	M	M[1]	H	0%[4]	1,000	500	500
N.F. Lewis	Stabilizing	VL	VL	VL	VL	VL	0%	na	150	--
E.F. Lewis [G]	Primary	VL	VH	M	VL[2]	H	>500%	600	<50	500
Washougal [C,G]	Primary	M	VH	M	M[1]	H	+40%	2,200	400	500
Gorge Winter										
L. Gorge (WA/OR)	Primary	L	VH	M	L[2]	H	+45%	na	200	300
U. Gorge (WA/OR)	Stabilizing	L	M	M	L[2]	L	0%	na	200	--
Hood (OR) [C,G]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Gorge Summer										
Wind [C]	Primary	VH	VH	H	H[1]	VH	0%[4]	na	1,000	1,000
Hood (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.

L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.

[1] Increase relative to interim Plan.

[2] Reduction relative to interim Plan.

[3] Addressed in Oregon Management Unit plan.

[4] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.

[C] Designated as a historical core population by the TRT.

[G] Designated as a historical legacy population by the TRT.

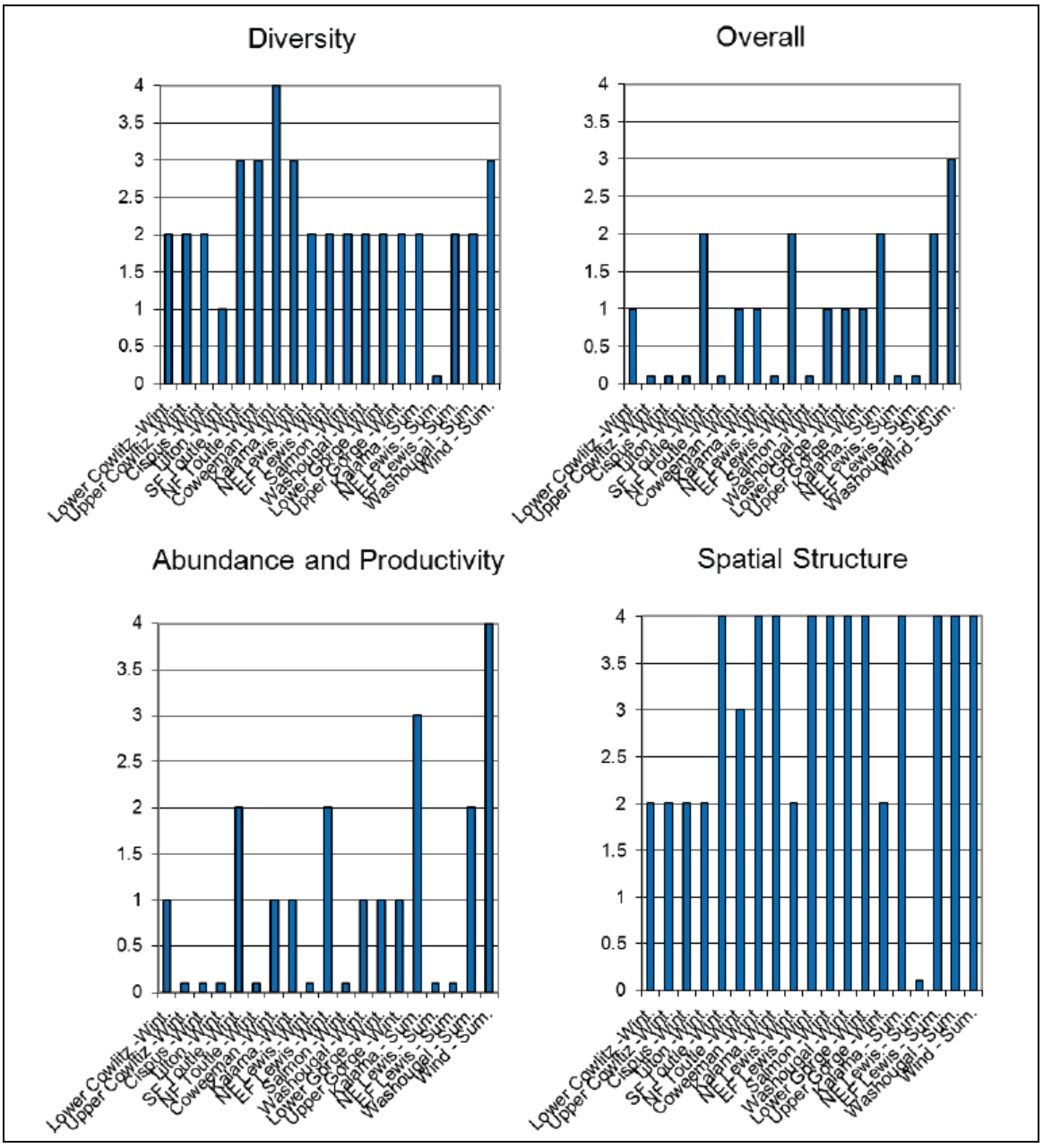

Figure 2.2.2.2: Current status of Washington LCR steelhead populations for the VSP parameters and overall population risk. (LCFRB 2010 Recovery Plan, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Lower Columbia River coho *(Oncorhynchus kisutch)*: Originally part of a larger Lower Columbia River/Southwest Washington ESU, Lower Columbia coho were identified as a separate ESU and listed as threatened on June 28, 2005. The ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers. The twenty-one artificial propagation programs include: the Grays River, Peterson Coho Project, Cowlitz Type-N Coho Program in the Upper and Lower Cowlitz Rivers, Cowlitz Game and Anglers Coho Program, Friends of the Cowlitz Coho Program, North Fork Toutle River Hatchery, Kalama River Type-N and Type-S Coho Programs, Lewis River Type-N and Type-S

Coho programs, Fish First Wild Coho and Type-N Coho programs, Syverson Project Type-N Coho Program, and Washougal Hatchery Type-N Coho Program (NMFS 2014 79FR20802).

Status: Status evaluations of LCR coho status, all based on WLC-TRT criteria, have been conducted since the last BRT status update in 2005 (McElhany et al. 2007, Beamesderfer et al. 2010, LCFRB 2010, Dornbusch and Sihler 2013). All of these evaluations concluded that the ESU is currently at very high risk of extinction. All of the Washington side populations are considered at very high risk, although uncertainty is high because of a lack of adult spawner surveys. The 2005 BRT evaluation noted that smolt traps indicate some natural production in Washington populations, though given the high fraction of hatchery origin spawners suspected to occur in these populations it is not clear that any are self-sustaining (Ford 2011). Since this time WDFW has implemented an ESU wide monitoring program for LCR coho which began in 2010. Preliminary results indicate that natural origin population abundance may be higher than previously thought for certain populations (WDFW, unpublished). Results from the first 3 years of monitoring should be available in the near future. Currently, 21 of the 24 Lower Columbia River coho salmon populations are considered to have a very low probability of persisting over the next 100 years, and none is considered viable (Dornbusch and Sihler 2013). All three strata in the ESU fall significantly short of the WLC TRT criteria for viability.

Table 2.2.2.3: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River coho populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast										
Grays/Chinook [L]	Primary	VL	H	VL	VL[2]	H	+370%	3,800	<50	2,400
Eloch/Skam [L]	Primary	VL	H	VL	VL[2]	H	+170%	6,500	<50	2,400
Mill/Ab/Germ [L]	Contributing	VL	H	L	VL[2]	M	>500%	2,800	<50	1,800
Youngs (OR) [L]	Stabilizing	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [L]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR) [L]	Primary[1]	--[3]	--[3]	--[3]	L	VH	--[3]	--[3]	--[3]	--[3]
Scappoose (OR) [L]	Primary	--[3]	--[3]	--[3]	M	VH	--[3]	--[3]	--[3]	--[3]
Cascade										
Lower Cowlitz [L]	Primary	VL	M	M	VL[2]	H	+100%	18,000	500	3,700
Upper Cowlitz [E, L]	Primary[1]	VL	M	L	VL	H[1]	>500%	18,000	<50	2,000
Cispus [E, L]	Primary[1]	VL	M	L	VL	H[1]	>500%	8,000	<50	2,000
Tilton [E, L]	Stabilizing[2]	VL	M	L	VL	VL[2]	0%	5,600	<50	--
Toutle SF [E, L]	Primary	VL	H	M	VL[2]	H	+180%	27,000	<50	1,900
Toutle NF [E, L]	Primary	VL	M	L	VL[2]	H	+180%		<50	1,900
Coweeman [L]	Primary	VL	H	M	VL[2]	H	+170%	5,000	<50	1,200
Kalama [L]	Contributing	VL	H	L	VL[2]	L	>500%	800	<50	500
NF Lewis [E, L]	Contributing	VL	L	L	VL[2]	L	+50%	40,000	200	500
EF Lewis [E, L]	Primary	VL	H	M	VL[2]	H	>500%	3,000	<50	2,000
Salmon [L]	Stabilizing	VL	M	VL	VL	VL	0%	na	<50	--
Washougal [L]	Contributing	VL	H	L	VL[2]	M+	>500%	3,000	<50	1,500
Clackamas (OR) [E, L]	Primary	--[3]	--[3]	--[3]	M	VH	--[3]	--[3]	--[3]	--[3]
Sandy (OR) [E, L]	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge										
L Gorge (WA/OR) [L]	Primary	VL	M	VL	VL[2]	H	+400%	na	<50	1,900
U Gorge (WA) [L]	Primary[1]	VL	M	VL	VL[2]	H	+400%	na	<50	1,900
U Gorge/Hood (OR)[E]	Contributing[4]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[1] Increase relative to interim Plan.
[2] Reduction relative to interim Plan.
[3] Addressed in Oregon Management Unit plan.
[4] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.
[E] Early run (Type S) coho stock.
[L] Late run (Type N) coho stock.
(Core and Legacy populations not designated by the TRT for coho).

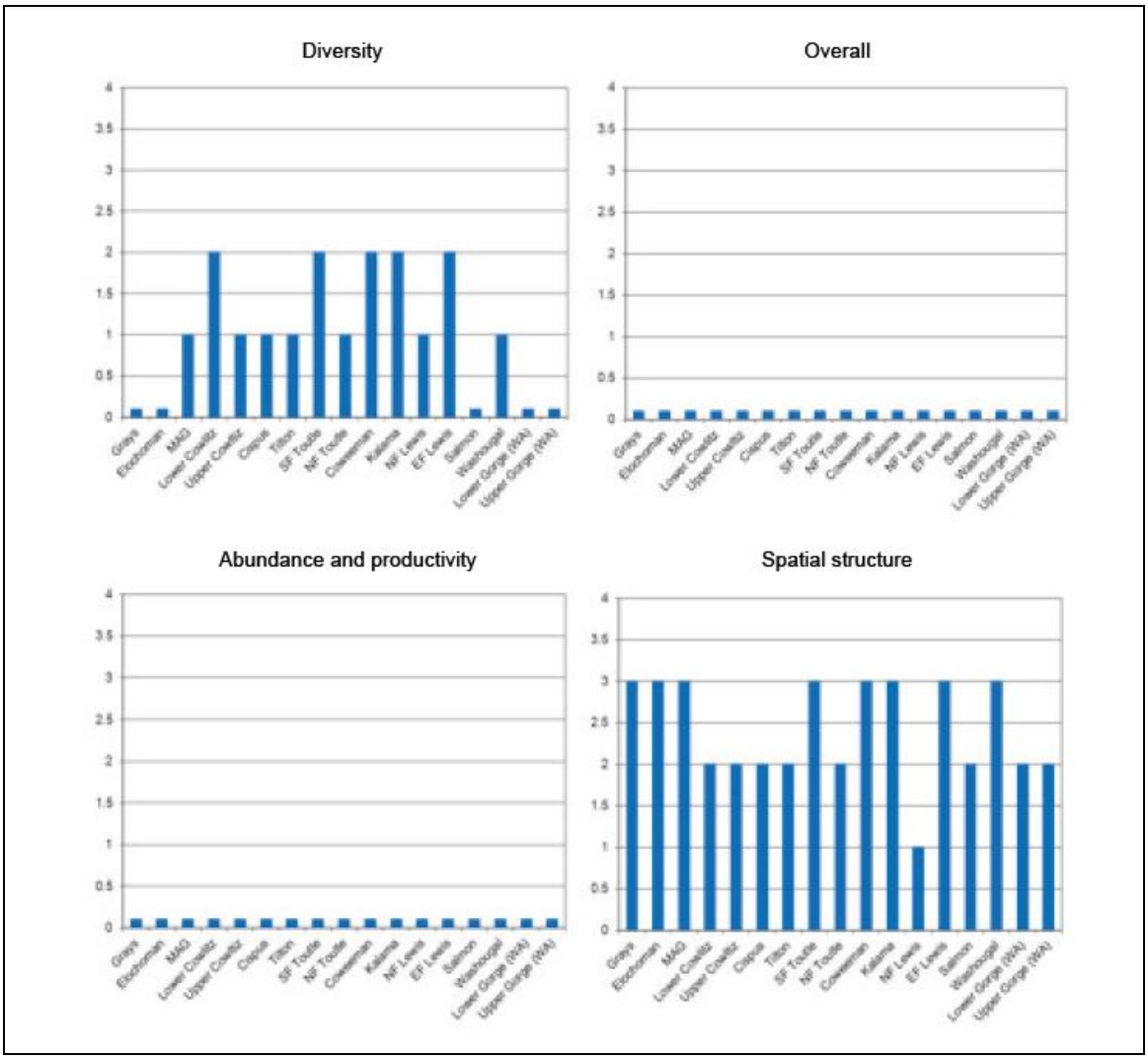

Figure 2.2.2.3: Current status of Washington LCR coho populations for the VSP parameters and overall population risk. (LCFRB 2010 recovery plan, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Columbia River chum salmon (*Oncorhynchus keta*). ESU includes all naturally spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon, as well as artificial propagation programs at Grays River and Washougal River/Duncan Creek chum hatchery programs (NMFS 2014 79FR20802).

Status: A report on the population structure of lower Columbia River salmon and steelhead populations was published by the WLC-TRT in 2006 (Myers et al. 2006). The chum population designations in that report are used in this status update and were used for status evaluations in recent recovery plans by ODFW and LCFRB.

Status: The LCFRB completed a revision recovery plan in 2010 that includes Washington populations of Columbia River chum salmon. This plan includes an assessment of the current status of Columbia River chum populations, which relied and built on the viability criteria developed by the WLC-TRT (McElhany et al. 2006) and an earlier evaluation of Oregon WLC populations (McElhany et al. 2007). This evaluation assessed the status of populations with regard to the VSP parameters of A/P, spatial structure, and diversity (McElhany et al. 2000). The result of this analysis is shown in **Figure 2.2.2.4**. The analysis indicates that all of the

Washington populations with two exceptions are in the overall very high risk category (also described as extirpated or nearly so). The Grays River population was considered to be at moderate risk and the Lower Gorge population to be at low risk. The very high risk status assigned to the majority of Washington populations (and all the Oregon populations) reflects the very low abundance observed in these populations (e.g., <10 fish/year) (Ford 2011). Today, 15 of the 17 populations that historically made up this ESU are so depleted that either their baseline probability of persistence is very low or they are extirpated or nearly so; this is the case for all six of the Oregon populations. Currently almost all natural production occurs in just two populations: Grays/Chinook and the Lower Gorge. All three strata in the ESU fall significantly short of the WLC TRT criteria for viability (Dornbush and Sihler 2013).

Table 2.2.2.4: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River chum populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast										
Grays/Chinook [C,G]	Primary	VH	M	H	M[1]	VH	0%[4]	10,000	1,600	1,600
Eloch/Skam [C]	Primary	VL	H	L	VL[2]	H	>500%	16,000	<200	1,300
Mill/Ab/Germ	Primary	VL	H	L	VL	H	>500%	7,000	<100	1,300
Youngs (OR) [C]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [C]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary[1]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary[1]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Cascade										
Cowlitz (Fall) [C]	Contributing	VL	H	L	VL	M	>500%	195,000	<300	900
Cowlitz (Summer) [C]	Contributing	VL	L	L	VL	M	>500%	n/a	n/a	900
Kalama	Contributing	VL	H	L	VL	M	>500%	20,000	<100	900
Lewis [C]	Primary	VL	H	L	VL	H	>500%	125,000	<100	1,300
Salmon	Stabilizing	VL	L	L	VL	VL	0%	n/a	<100	--
Washougal	Primary	VL	H	L	VL[2]	H+	>500%	18,000	<100	1,300
Clackamas (OR) [C]	Contributing	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Sandy (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge										
L. Gorge (WA/OR) [C,G]	Primary	VH	H	VH	H[1]	VH	0%[4]	6,000	2,000	2,000
U. Gorge (WA/OR)	Contributing	VL	L	L	VL	M	>500%	11,000	<50	900

Source: LCFRB 2010.

L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.

[5] Increase relative to interim Plan.

[6] Reduction relative to interim Plan.

[7] Addressed in Oregon Management Unit plan.

[8] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.

[C] Designated as a historical core population by the TRT.

[G] Designated as a historical legacy population by the TRT.

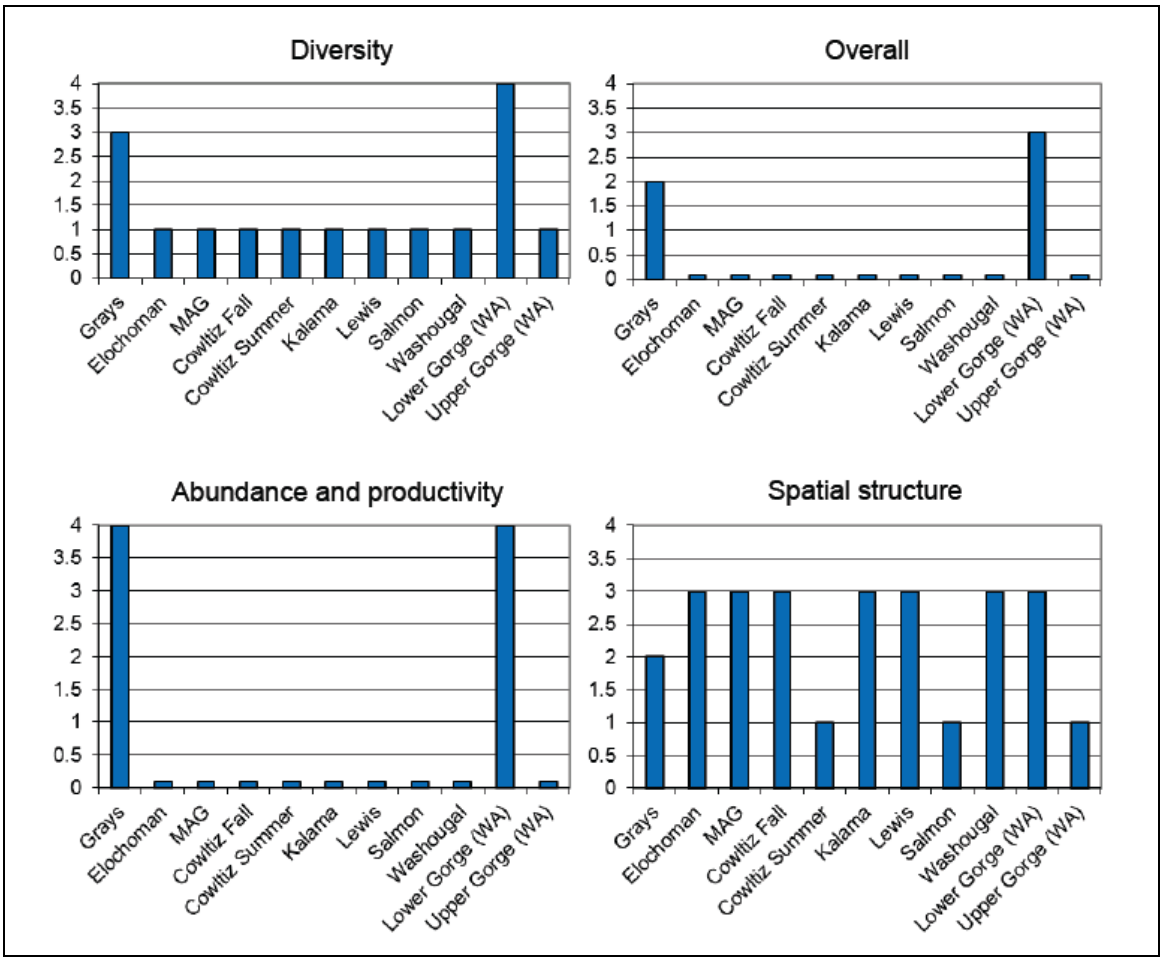

Figure 2.2.2.4: Current status of Washington CR chum populations for the VSP parameters and overall population risk. (LCFRB 2010 Recovery Plan, Chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population.

Juvenile coho production estimates is the one measure of production in the Lower Columbia system. See HGMP section 11.1 for planned M&E.

Table 2.2.2.5: Lower Columbia River Washington tributary coho smolt production estimates, 1997-2009 (WDFW, Region 5).

Year	Cedar Creek	Mill Creek	Abernathy Creek	Germany Creek	Cowlitz Falls Dam	Mayfield Dam
1997	-----	-----	-----	-----	3,700	700
1998	38,400	-----	-----	-----	110,000	16,700
1999	28,000	-----	-----	-----	15,100	9,700
2000	20,300	-----	-----	-----	106,900	23,500
2001	24,200	6,300	6,500	8,200	334,700	82,200
2002	35,000	8,200	5,400	4,300	166,800	11,900
2003	36,700	10,500	9,600	6,200	403,600	38,900
2004	37,000	5,700	6,400	5,100	396,200	36,100
2005	58,300	11,400	9,000	4,900	766,100	40,900
2006	46,000	6,700	4,400	2,300	370,000	33,600
2007	29,300	7,000	3,300	2,300	277,400	34,200
2008	36,340	90,97	5,077	3,976	-----	38,917
2009	61,140	62,83	3,761	2,576	-----	29,718
2010	-----	-----	-----	-----	-----	49,171
2011	-----	-----	-----	-----	-----	43,831

Source: LCR FMEP Annual Report 2010 and WDFW Data 2012.

- Provide the most recent 12 year annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Table 2.2.2.6: Spring Chinook salmon total spawner abundance estimates in LCR tributaries, 2000-2012.

Year	Cowlitz	Kalama	Lewis
2000	266	34	523
2001	347	578	754
2002	419	898	498
2003	1,953	790	745
2004	1,877	358	529
2005	405	380	122
2006	783	292	857
2007	74	2,150	264
2008	425	364	40
2009	763	34	80
2010	711	0	160
2011	1,359	26	120
2012	1,359	28	200

Source: Joe Hymer, WDFW Annual Database 2012.

Table 2.2.2.7: Fall Chinook salmon total spawner abundance estimates in LCR tributaries, 2000-2011[a].

Year	Elochoman River	Coweeman River[a]	Grays River	Skamokawa Creek	Cowlitz River	Green River (Toutle)	SF Toutle River	Kalama River	EF Lewis River	NF Lewis River	Washougal River
2000	884	424	80	482	2,100	1,580	204	3,877	391	6,504	2,757
2001	230	251	104	3	1,979	1,081	102	3,451	245	4,281	1,704
2002	332	566	390	7	3,038	5,654	216	10,560	441	5,518	2,728
2003	2,204	753	149	529	2,968	2,985	327	9,272	607	11,519	2,678
2004	4,796	1,590	745	2,109	4,621	4,188	618	6,680	918	13,987	10,597
2005	6,820	1,090	387	588	10,329	13,846	140	24,782	727	18,913	3,444
2006	7,581	900	82	372	14,427	7,477	450	18,952	1,375	17,106	6,050
2007	194	140	99	36	2,724	961	30	1,521	308	10,934	2,143
2008	782	95	311	253	1,334	824	45	2,617	236	4,268	3,182
2009	231	147	93	139	2,156	1,302	66	4,356	110	6,112	2,995
2010	1,883	1,330	12	268	2,762	605	NE	3,576	314	8,908	4,529
2011	508	2,148	353	41	1,616	668	NE	10,639	334	14,033	2,961

Source: Ron Roler, WDFW Natural Spawn Progress Reports 2012.

* Estimates of total adult and jack fall Chinook. May include fish put upstream of hatchery weirs.

Table 2.2.2.8: Wild winter steelhead escapement estimates for select SW Washington DPS populations, current WDFW escapement goals and LCSRP abundance targets.

Location	Grays River	Elochoman/ Skamokawa	Mill/Abernathy/ Germany
WDFW Escapement Goal	**1,486**	**853**	**508**
LCSRP Abundance Target	**800**	**600**	**500**
2000	1,064	650	380
2001	1,130	656	458
2002	724	370	354
2003	1,200	668	342
2004	1,132	768	446
2005	396	376	274
2006	718	632	398
2007	724	490	376
2008	764	666	528
2009	568	222	396
2010	422	534	398
2011	318	442	270
3-year average	**436**	**399**	**355**
5-year average	**559**	**471**	**394**
10-year average	**697**	**517**	**378**

Source: WDFW Data 2012.

Table 2.2.2.9: Wild winter steelhead escapement estimates for select SW Washington DPS populations, current WDFW escapement goals and LCSRP abundance targets.

Location	Coweeman	SF Toutle	NF Toutle/ Green	Kalama	EF Lewis	Washougal
WDFW Escapement Goal	**1,064**	**1,058**	**NA**	**1,000**	**1,243**	**520**
LCSRP Abundance Target	**500**	**600**	**600**	**600**	**500**	**350**
2000	530	490	----	921	NA	NA
2001	384	348	----	1,042	377	216
2002	298	640	----	1,495	292	286
2003	460	1,510	----	1,815	532	764
2004	722	1,212	----	2,400	1,298	1,114
2005	370	520	388	1,856	246	320
2006	372	656	892	1,724	458	524
2007	384	548	565	1,050	448	632
2008	722	412	650	776	548	732
2009	602	498	699	1,044	688	418
2010	528	274	508	961	336	232
2011	408	210	416	622	308	204
3-year average	**513**	**327**	**541**	**876**	**444**	**285**
5-year average	**529**	**388**	**568**	**891**	**466**	**444**
10-year average	**487**	**648**	***588**	**1,374**	**515**	**523**

Source: WDFW Data 2012.
* 7-year average for NF Toutle/Green.

Table 2.2.2.10: Wild summer steelhead population estimates for LCR populations from 2001 to 2011, current WDFW escapement goals, and LCSRP abundance targets.

Location	Kalama	EF Lewis	Washougal	Wind
WDFW Escapement Goal	**1,000**	**NA**	**NA**	**1,557**
LCSRP Abundance Target	**500**	**500**	**500**	**1,000**
2001	286	271	184	457
2002	454	440	404	680
2003	817	910	607	1,096
2004	632	425	NA	861
2005	400	673	608	587
2006	387	560	636	632
2007	361	412	681	737
2008	237	365	755	614
2009	308	800	433	580
2010	370	602	787	788
2011	534	1,084*	956*	1,468
3-year average	**404**	**829**	**725**	**945**
5-year average	**362**	**653**	**722**	**837**
10-year average	**450**	**627**	**652**	**804**

Source: WDFW Data 2012.
* Preliminary estimates.

Table 2.2.2.11: Population estimates of chum salmon in the Columbia River.

Location	2002	2003	2004	2005	2006	2007	2008	2009	2010[a]	2011[a]
Crazy Johnson Creek	---	---	966	1,471	3,639	759	1,034	981	677	2,374
WF Grays River	---	---	9,015	1,324	1,232	1,909	800	994	1,967	7,002
Mainstem Grays River	---	---	4,872	1,400	1,244	1,164	886	750	3,467	1,848
I-205 area	3,468	2,844	2,102	1,009	862	544	626	1,132	2,105	4,947
Multnomah area	1,267	1,130	665	211	313	115	28	102	427	641
St Cloud area	---	137	104	92	173	9	1	14	99	509
Horsetail area	---	---	106	40	63	17	33	6	45	183
Ives area[b]	4,466	1,942	363	263	387	145	168	141	214	162
Duncan Creek[c]	13	16	2	7	42	9	2	26	48	85
Hardy Creek	343	392	49	73	104	14	3	39	137	173
Hamilton Creek	1,000	500	222	174	246	79	114	115	247	517
Hamilton Spring Channel	794	363	346	84	236	44	109	91	187	324
Grays return[d]	12,041	16,974	15,157	4,327	6,232	3,966	2,807	2,833	6,399	11,518
I-205 to Bonneville return	11,351	7,324	3,959	1,953	2,426	976	1,084	1,666	3,509	7,541
Lower Columbia River Total	23,392	24,298	19,116	6,280	8,658	4,942	3,891	4,499	9,908	19,059

Source: Todd Hillson - WDFW Chum Program 2012.

[a] Data for 2010 and 2011 is preliminary.

[b] Ives area counts are the carcass tagging estimate plus fish removed for broodstock, except for 2007 and 2008, which is area under the curve.

[c] Totals for Duncan Creek do not include broodstock brought in from mainstem spawning areas, adult trap catch or surveys below monitoring weirs only..

[d] Grays return totals include natural spawners and removed for broodstock.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Lower Columbia River Coho *(Oncorhynchus kisutch)*: In the lower Cowlitz, Mayfield Dam has blocked tributaries above river mile (RM) 52 since 1968 but natural production still occurs in several small tributaries of the lower Cowlitz including Olequa, Lacamas, Ostrander, Blue, Otter, Brights, Mill, Arkansas, Foster, and Hill creeks. Adults are also released each year to spawn in the Tilton River and upper Cowlitz system. Presently, most Cowlitz River coho are of hatchery-origin although significant numbers of NOS have been identified and taken to the upper Cowlitz (**Table 2.2.2.12**) and the Tilton River system (**Table 2.2.2.13)**. Fish collection efficiency (FCE) of coho smolts in 2004 was 42% with 128,161 coho smolts collected at the CFFF with a majority of them transported to the Cowlitz Salmon Hatchery Stress Relief ponds. Total smolt production was 308,079. Based on a maximum potential egg deposition of 92 million eggs, egg-to-smolt survival was 0.33%.

The Northwest Power Planning Council's model estimated smolt production capacity of 123,123 for the lower Cowlitz River, 131,318 for Tilton River and Winston Creek, and 155,018 for above Cowlitz Falls.

Table 2.2.2.12: Coho Adults Transported to the Upper Cowlitz River Basin, 1996-present.

	Unmarked/Natural Production				Hatchery				Integrated Hatchery			
	F	M	Jx	Total	F	M	Jx	Total	F	M	Jx	Total
1997-98					2,774	1,262	464	4,500				
1998-99					4,128	4,140	3,154	11,422				
1999-00	2,398	2,383	120	4,901	10,594	11,635	7,197	29,426				
2000-01	514	778	284	1,576	14,653	16,674	9,566	40,893				
2001-02	1,150	1,644	96	2,890	15,504	21,564	1,497	38,565				
2002-03	3,661	4,688	416	8,765	23,698	30,490	6,300	60,488				
2003-04	3,477	4,511	484	8,472	9,526	11,169	6,143	26,838				
2004-05	2,187	2,507	201	4,895	14,015	14,650	2,528	31,193				
2005-06	2,581	3,191	221	5,993	9,539	12,780	3,588	25,907				
2006-07	2,181	3,305	242	5,728	10,950	14,624	2,907	28,481				
2007-08	1,682	2,082	160	3,924	2,642	3,049	688	6,379				
2008-09	2,080	2,669	295	5,044	6,534	7,271	1,495	15,300				
2009-10	2,434	3,317	122	5,873	7,550	8,612	783	16,945	0	0	485	485
2010-11	1,257	1,446	203	2,906	4,347	4,162	393	8,902	5,314	5,082	459	10,855
2011-12	4,070	3,653	159	7,882	37	99	3	139	6,480	710	631	7,821
2012-13	658	960	71	1,689					1,199	1,198	2,879	5,276
2013-14				5								7,940
Ave.	2,166	2,652	220	4,703	9,099	10,812	3,114	23,025	3,248	1,748	1,114	6,475

Note: Integrated hatchery coho are 100% natural-origin brood from Upper Cowlitz natural-origin returns.
Source: John Serl, Cowlitz Fall Fish Facility Biologist, 2014.

Table 2.2.2.13: Coho Adults Transported to Tilton River Basin, 1996-present.

		Unmarked Coho				Ad Coho			
Year	Release Site	Females	Males	Jacks	Total	Females	Males	Jacks	Total
1996-1997	Tilton R.	663	1147	2188	3998	0	0	0	0
1997-1998	Tilton R.	867	2766	272	3905	0	0	112	112
1998-1999	Tilton R.	523	634	459	1616	899	1102	1944	3945
1999-2000	Tilton R.	574	678	29	1281	2485	3094	2500	8079
2000-2001	Tilton R.	265	401	138	804	7442	877	5813	14132
2001-2002	Tilton R.	382	616	126	1124	6904	8755	1433	17092
	Mayfield L	278	448	30	756	4913	4874	280	10067
2002-2003	Tilton R.	560	495	16	1071	4670	4751	360	9781
	Mayfield L	262	413	58	733	2781	4445	1415	8641
2003-2004	Tilton R.	220	365	75	660	3425	3317	1848	8590
	Mayfield L	2	14	0	16	1	4	0	5
2004-2005	Tilton R.	181	217	38	436	5872	6218	1096	13186
	Mayfield L	150	174	25	349	73	80	12	165
2005-2006	Tilton R.	557	704	75	1336	3202	3975	919	8096
	Mayfield L	26	45	11	82	22	60	11	93
2006-2007	Tilton R.	184	228	16	428	175	196	13	384
	Mayfield L	111	215	54	380	308	949	173	1430
2007-2008	Tilton R.	341	374	30	745	807	654	14	1475
	Mayfield L	35	77	6	118	67	56	0	123
2008-2009	Tilton R.	354	454	104	912	958	835	254	2047
	Mayfield L	44	63	19	126	0	7	0	7
2009-2010	Tilton R.	423	484	32	939	1602	1464	220	3286
	Mayfield L	143	255	10	408	3	8	1	12
2010-2011	Tilton R.	416	513	104	1033	1584	2111	243	3938
	Mayfield L	0	0	0	0	0	0	0	0
2011-2012	Tilton R.	988	999	62	2049	3171	2744	427	6342
	Mayfield L	10	28	1	39	110	166	15	291
2012-2013	Tilton R.	565	736	141	1442	2392	2529	1583	6504
2013-2014	Tilton R.	1151	1593	230	2974	2662	2959	7790	13411
Average		**354**	**522**	**150**	**1026**	**1949**	**1939**	**982**	**4870**

Note: Integrated hatchery coho are 100% natural-origin brood from upper Cowlitz natural-origin returns.
Source: Chris Gleizes, Cowlitz Evaluation Biologist, 2014.

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

The following hatchery activities are identified in the ESA Section 7 Consultation "Biological Opinion on Artificial Propagation in the Columbia River Basin" (March 29, 1999). In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependent on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities. Broodstock collection activities will directly handle listed fish and will have "take" tables associated with direct broodstock collection or with listed fish lost during handling for release. These tables will occur at the end of this HGMP.

Broodstock Program:

Broodstock Collection: Cowlitz Type-N hatchery coho are included in the ESA listing for the Lower Columbia River ESU (NMFS 2005). The Cowlitz Barrier Dam adult collection facility enables the program to discriminate all returning adult fish according to hatchery and natural-origin fish, since the program fish releases are 100% marked. The ability to discriminate hatchery/natural origin fish assures that the program/stock adheres to proper integrated stock criteria, particularly populations in the upper Cowlitz River and tributaries. All wild salmonids not collected for brood are transported to the upper Cowlitz basin and tributaries for natural spawning. Mortality during transport is reported in the "take" tables at the end of this document.

Genetic introgression: When it began, the broodstock for this program used naturally produced coho salmon from the Cowlitz River and the management plan for the hatchery prevents any other stock of coho salmon to be used in the broodstock or released into the basin. Few transfers into the basin have occurred since the program was started. Egg-takes are representative of adults arriving throughout the run and the current collection protocol best preserves the one "wide range timing" of the historical coho stock in the system.

Rearing Program:

Operation of Hatchery Facilities: Facility operation impacts include water withdrawal, effluent, and intake compliance. Effluent at outfall areas is rapidly diluted with mainstem flows and operation is within non-permitted guidelines (NPDES guidelines).

Disease: Over the years, rearing densities, disease prevention and fish health monitoring have greatly improved the health of the hatchery programs. *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (IHOT 1995) Chapter 5 have been instrumental in reducing disease outbreaks. While pathogens occur and may affect fish in the wild, they are believed to go undetected, and are quickly removed through predation. Furthermore, while the Cowlitz Salmon or Cowlitz Trout Hatcheries have been noted as potential sources of fish pathogens including bacterial kidney disease, *Ceratomyxa shasta*, and IHNV, these diseases are also present in the natural spawning populations (Tacoma Power 2000).

In addition, although pathogens may cause post release mortality in fish from hatcheries, there is little evidence that hatchery-origin fish routinely infect natural populations of salmon and steelhead in the Pacific Northwest (Enhancement Planning Team 1986 and Stewart and Bjornn 1990). Prior to release, the health and condition of the hatchery population is established by the Cowlitz Fish Health Specialist. This is commonly done one to three weeks prior to release, and up to six weeks on systems with pathogen-free water and little or no history of disease. Indirect take from disease is unknown.

Release:

Hatchery Production/Density-Dependent Effects: To reduce interactions between coho hatchery fish and ESA-listed fish, hatchery production for all species throughout the 35-year re-licensing term in the remodeled facility will be established after rebuild (completed in 2010) and negotiations with NOAA, WDFW and Tacoma Power. Releases from 2003 will be 3.2 million, with the after remodel (>2010) level reduced further to 2.2 million pending agreement on upstream credit mechanisms (Section 3.7 FHMP), fish passage improvements and upper basin overall productivity. Any future hatchery consultation will be in the overall context, or to meet the goal of re-establishing self-sustaining population levels consistent with a viable ESU scenario. When the plan is updated, NOAA Fisheries will be consulted to determine if re-initiation of the consultation is warranted. At which time, NOAA Fisheries will consider the potential for both beneficial and adverse effects to listed species.

RSI units can hatch and produce up to 95% swim-up fry from the units compared to wild spawning, with swim-up rates of 5-20% depending on habitat. Applying smolt contribution observed at Cedar Creek indicates that individual RSIs could have a 0.275% eyed egg-to-smolt

contribution to individual tributaries. Impacts to total smolt production in the lower Cowlitz River system (estimated at 123,123 smolts EDT LCFRB Basin Plans 2004) are unknown.

Potential Cowlitz hatchery coho predation and competition effects on listed salmonids and eulachon. The proposed annual production goal for the on-station program is around 2.2-million fish. Fish at release average 15 fpp (155 mm fl) and are released in late-April/early-May. Coho leave the RSI at approximately 1,500 fpp (30-35 mm fl) starting in March-April. Coho fry from the RSI program pose no known predatory risk to listed salmonids during the first year of rearing. If they survive to a yearling stage, they could pose an unknown predatory risk to listed fish <40mm fl. In Cedar Creek, smolt trapping data (March-Jun, 2003) indicated the average size of wild coho smolt emigrating past the trap to be 121 mm fl (90-198 mm fl). Research on RSI-produced coho in Snow and Andrews creeks on the Olympic Peninsula (WDOT, 2002) indicated that coho ranged from 36-40 mm fl in April to 40-55mm fl in May to 60 mm fl in June. Smolted coho captured during this study (May) ranged from 80-105mm fl.

Kinsel et al. 2009 (**Table 2.2.3.1**) indicates that the majority of naturally-produced Chinook and coho would have out-migrated by the target May 1st release date. In addition, natural-origin coho are of a size precluding predation by hatchery fish.

Table2.2.3.1: Peak migration timing and average fork length (mm) of out-migrant juvenile Chinook, coho and steelhead captured in rotary screw traps on Mill, Germany and Abernathy creek, Lower Columbia River, 2008.

Stream	Chinook		Coho		Steelhead	
	Avg Size (mm)	Peak Migration	Avg Size (mm)	Peak Migration	Avg Size (mm)	Peak Migration
Mill Cr	37.0	Mar 10-Apr 13	104.2	Mar 17-23	154.5	Apr 28-May 4
Germany Cr	39.8	Mar 17-23	115.3	May 19-25	177.8	May 12-18
Abernathy Cr	37.9	Mar 31 – Apr 6	112.1	May 19-25	163.8	May 12-18

Source: Kinsel et al 2009.

RSI incubation techniques can have egg-to-fry survival rates of well over 95%, a significant increase over values reported for naturally incubated eggs. Releasing unfed fry into reduced rearing habitat (due to reduced summer flows, etc.) could increase competition for food and habitat. RSI programs have been located in areas that need re-seeding and where wild fry competition would be minimal.

Both juvenile and adult salmonids have been documented to feed on eulachon (Gustafson et al. 2010). Predation of eulachon by coho reared in this program may occur, however it is unknown to what degree such predation may occur.

Table 2.2.3.2: Annual smolt collection by species and origin at the Cowlitz Falls Fish Facility from 1997 through 2013.

	Chinook			Steelhead			Coho		Cutthroat	
	Sub-yearling		Unmarked							Total
Season	Hatchery[1]	Unmarked	Yearling	Hatchery	Natural	Unmarked[2]	Unmarked[3]	Unmarked	Unmarked	Smolt
2013		21,760	508			6,757		213,703	380	243,108
2012		23,165	28	0	1	981		10,504	152	34,831
2011	1,234	4,819	4	1	220	5,742		34,632	314	46,966
2010	21,690	10,121	45	7	3,256	9,324		110,378	485	155,306
2009	32,218	2,816	28	8,145	1,586	4,407		40,697	281	90,178
2008	13,870	1,135	10	12,200	837	2,664		14,315	185	45,216
2007	15,778	284	55	19,414	2,401	8,117		104,277	715	151,041
2006	35,997	5,330	54	19,747	1,768	9,585		74,228	738	147,447
2005	11,554	3,222	35	25,345	3,561	17,338		264,921	1,026	327,002
2004	21,195	8,382	20	18,714	5,042	11,276		128,148	718	193,495
2003	26,982	7,741	18	16,463	170	14,740		173,540	1,280	240,934
2002	20,733	5,595	0	591	23,162	5,247		55,029	990	111,347
2001	36,450		25	4,901	33,491	17,807		334,718	1,077	428,469
2000	32,704			89	16,404	17,023	106,880		1,343	174,443
1999	8,878			31	10,783	10,001	15,120		545	45,358
1998	14,917			22	25,921	15,691	109,974		888	167,413
1997	22,815			37	15,621	2,777	3,673		260	45,183
Total	317,015	94,370	830	125,707	144,224	159,477	235,647	1,559,090	11,377	2,647,737

1] 2004-08 numbers based on RV clipped fish captured. 2002 and 2003 based on relative size.

2] Unmarked fish from 2004 onward are assumed to be naturally produced. 2002 and 2003 unmarked numbers based on VIE marking a portion of fry plant. 1997-2001 numbers are a mix of unmarked hatchery fry plants and natural production.

3] Coho smolts from 1997-2000 were a mix of hatchery fry and natural production. Coho smolts from 2001 onward are naturally produced.

Source - Draft Annual Report for the Cowlitz Falls from 1997- 2013.

Residualism: To maximize smolting characteristics and minimize residualism, WDFW adheres to a combination of acclimation, volitional release strategies, size, and time guidelines.

- Condition factors, standard deviation and co-efficient of variation (CV) are measured throughout the rearing cycle and at release.
- Feeding rates and regimes throughout the rearing cycle are programmed to satiation feeding to minimize out-of-size fish and programmed to produce smolt size fish at date of release.
- Based on past history, fish have reached a size and condition that indicates a smolted condition at release.
- Releases occur within known time periods of species emigration from acclimated ponds.
- Releases from these ponds are volitional with large proportions of the populations moving out initially with the remainder of the population vacating within days or a few weeks.
- Minimal residualism from WDFW Chinook programs following these guidelines has been indicated from snorkeling studies on the Elochoman River (Fuss et al. 2000) and on Nemah and Forks Creek (Riley et al. 2004). In extensive surveys conducted on the Lewis River, Hawkins and Tipping (1999) found no residualized hatchery spring Chinook. Indirect take from residualism is unknown.

Residualism from unfed fry releases are unknown.

Monitoring:

Associated monitoring Activities: Interaction between hatchery and wild adult salmonids will be managed by monitoring key tributary escapements of coho, steelhead, cutthroat and chum. Interaction between hatchery-released fish and wild fish in the lower Cowlitz will be studied and may result in review of release strategies.

The following monitoring baseline activities are conducted in the Lower Columbia Management Area (LCMA) for adult steelhead and salmon: redd surveys are conducted for winter steelhead in the SF Toutle, Coweeman, EF Lewis and Washougal rivers. Redd surveys are also conducted in

the Cowlitz River for fall and spring Chinook. Mark-recapture surveys provide data for summer steelhead populations in the Wind and Kalama rivers. Mark-recapture carcass surveys are conducted to estimate populations of Chinook salmon in Grays, Elochoman, Coweeman, SF Toutle, Green, Kalama, NF Lewis, EF Lewis, rivers and Skamokawa, Mill, Abernathy, and Germany creeks and for all chum salmon populations. Snorkel surveys are conducted for summer steelhead in the EF Lewis and Washougal rivers. Trap Counts are conducted on the Cowlitz, NF Toutle, Kalama, and Wind rivers and on Cedar Creek a tributary of the NF Lewis River. Area-Under-the-Curve (AUC) surveys are conducted to collect population data for chum salmon in Grays River and Hardy and Hamilton Creeks. All sampling of carcasses and trapped fish include recovery of coded wide tagged (CWT) fish for hatchery or wild stock evaluation. Downstream migrant trapping occurs on the Cowlitz, Kalama, NF Lewis, and Wind rivers, Cedar Creek, and will expand to other basins as part of a salmonid life cycle monitoring program to estimate freshwater production and wild smolt to adult survival rates. Any take associated with monitoring activities is unknown but all follow scientific protocols designed to minimize impact.

See also HGMP section 11.1.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken and observed injury or mortality levels for listed fish.

Table 2.2.3.3: Disposition of unmarked (no adipose fin-clip) coho returning to Cowlitz Salmon Hatchery.

Brood Year	Mortality
2007	68
2008	150
2009	78
2010	85
2011	120
2012	88
Average	**98**

Source: WDFW Hatcheries Headquarters Database 2014.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See "Take" tables to be submitted to NMFS. The impacts from harvest are included in the FMEPs.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

No situations are expected to occur where take would exceed ESA limits. If significant numbers of wild salmonids are observed impacted by this operation, then staff would inform the WDFW District Biologist, Fish Health Specialist or Area Habitat Biologist who, along with the Hatchery Complex Manager, would determine an appropriate plan and consult with NOAA-NMFS for adaptive management review and protocols.

Handling and release of wild coho in broodstock trapping operations is monitored and take observations have been rare. Any additionally mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance.

3 SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. Hood Canal Summer Chum Conservation Initiative) or other regionally accepted policies (e.g. the NPPC Annual Production Review Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

WDFW has several policies/plans that help inform management decisions regarding the HGMPs currently under review. These policies include:

1. Hatchery and Fishery Reform Policy (Commission Policy C3619)
2. The Conservation and Sustainable Fisheries Plan (draft)
3. The Hatchery Action Implementation Plans (HAIP)
4. Lower Columbia Salmon Recovery Plan (LCSRP)

Descriptions of these policies and excerpts are shown below:

Policies/Plans – Key Excerpts

Hatchery and Fishery Reform Policy: Washington Department of Fish and Wildlife Commission Policy C-3619. WDFW adopted the Hatchery and Fishery Reform Policy C-3619 in 2009. Its purpose is to advance the conservation and recovery of wild salmon and steelhead by promoting and guiding the implementation of hatchery reform. The intent of hatchery reform is to improve hatchery effectiveness, ensure compatibility between hatchery production and salmon recovery plans and rebuilding programs, and support sustainable fisheries. WDFW Policy C-3619 works to promote the conservation and recovery of wild salmon and steelhead and provide fishery-related benefits by establishing clear goals for each state hatchery, conducting scientifically defensible-operations, and using informed decision making to improve management. It is recognized that many state operated hatcheries are subject to provisions under *U.S. v Washington* (1974) and *U.S. v Oregon* and that hatchery reform actions must be done in close coordination with tribal co-managers. Washington Fish and Wildlife Commission Policy: POL-C3619.

Guidelines from the policy include:

1. Use the principles, standards, and recommendations of the Hatchery Scientific Review Group (HSRG) to guide the management of hatcheries operated by the Department.
2. Develop watershed-specific action plans that systematically implement hatchery reform as part of a comprehensive, integrated (All-H) strategy for meeting conservation and harvest goals at the watershed and Evolutionarily Significant Unit (ESU)/Distinct Population Segment (DPS) levels. Action Plans will include development of stock (watershed) specific population designations and application of HSRG broodstock management standards.

Conservation and Sustainable Fisheries Plan (CSFP): The CSFP is a draft plan that has been developed to meet WDFW's responsibilities outlined in the Lower Columbia Salmon Recovery Plan (LCSRP) and address the HSRG suggested solutions and achieve HRSG standards for primary, contributing and stabilizing populations. The plan describes the implementation of changes to hatchery and harvest programs and how they assist in recovery and achieve HSRG guidelines. The draft plan also identifies Viable Salmonid Population (VSP) parameters that will be addressed.

Hatchery Action Implementation Plans (HAIP): The HAIPs illustrate how WDFW is implementing hatchery programs to incorporate the HSRG guidelines. The plans provide the current programs and explain the future goals.

Lower Columbia Salmon Recovery Plan (LCSRP): Some sub-basins will be free of hatchery influence and hatchery programs. In other sub-basins, hatchery programs will serve specific conservation and harvest purposes consistent with goals for naturally-spawning populations. The mosaic of programs is designed to ensure that overall each DPS will be naturally self-sustaining.

Strategies

1. Reconfigure production-based hatchery programs to minimize impacts on natural populations and complement recovery objectives.
2. Adaptively manage hatcheries to respond to future knowledge, enhance natural production, and improve operational efficiencies.

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

Future Brood Document. Hatchery salmon and steelhead production levels are detailed in the annual Future Brood Document, a pre-season planning document for fish hatchery production in Washington State for the upcoming brood stock collection and fish rearing season (July 1 – June 30).

Cowlitz Basin Fish Management Plan. The Department of Fish and Wildlife has developed a framework for a fish management plan for the Cowlitz River basin. This plan is intended to provide management direction for fish protection and restoration in a manner that is consistent with the Endangered Species Act (ESA) and the Wild Salmonid Policy (WSP). The Wild Salmonid Policy was developed by WDFW in response to a mandate from the Washington State Legislature (ESHB 1309) in 1993.

Cowlitz Hatchery Mitigation Agreement (*FERC Project #2016*). After the original license expired on December 31, 2001, the Project has operated under annual licenses until the new thirty-five year license was issued March 13, 2003 (effective on July 18, 2003). The new license requires formation of the Cowlitz Fisheries Technical Committee (FTC), which includes NMFS, USFWS, WDFW, WDOE, American Rivers/Trout Unlimited, the Yakama Nation, and Tacoma Power. The FERC license was amended July 2004, based on NOAA's Biological Opinion that required Tacoma Power to achieve a fish passage survival goal of 75-95% (with best available technology). Tacoma Power has published an annual progress report since 2005.

Cowlitz Fisheries and Hatchery and Management Plan (*FHMP*). The FHMP is part of the new Settlement Agreement (Article 6), that identifies the quantity and size of fish produced at the hatcheries, the rearing and release strategies for each stock, plans for funding on-going monitoring and evaluation, and management strategies consistent with the objective of maximizing natural-origin fish production. The plan requires updates every six-years.

Cowlitz Falls Project- Lewis County Public Utility District (*PUD*) (*FERC No. 2833*). The Lewis County PUD No. 1 constructed a hydroelectric project on the Cowlitz River, which was completed in 1994. BPA constructed and oversees the operation of a downstream fish collection facility at the dam. NOAA issued a Biological Opinion dated June 2, 2009.

Legislative Code RCW 77.95.200 "RSI Programs". Formerly RCW 75.50.190, Legislative Code RCW 77.95.200 (effective 2010) describes the role, goals, site selection and monitoring of RSI programs "to assist the reestablishment of wild salmon and trout populations that are self-sustaining through natural spawning."

Cooperative Fish and Wildlife Project Memorandum of Understanding Fish Production Agreement. This cooperative agreement is used to monitor volunteer co-operative programs. Under the terms of the agreement, the Cooperator is responsible for: a) obtaining permission to work on private property; b) maintaining a list of volunteer workers and their hours of work; and c) submitting completed annual

planting slips to WDFW within 30 days of release. The Cooperator shall also be responsible for obtaining and complying with any and all necessary permits to conduct the project(s), which may include but are not limited to: Hydraulic Project Approvals (HPA), State Environmental Protection Act checklist (SEPA), National Pollution Discharge Elimination System (NPDES), Water Rights, local construction, grading, or filling permits, etc., with the exception of federal ESA compliance, which can only be deferred upon WDFW or the Treaty Tribes of Washington.

See also HGMP section 3.1 above.

3.3 Relationship to harvest objectives.

Total annual harvest is dependent on management response to annual abundance in Pacific Salmon Commission (PSC - U.S./Canada), Pacific Fishery Management Council (PFMC - U.S. ocean), and Columbia River Compact forums. WDFW has also received authorization for tributary, Columbia River mainstem, and ocean fisheries; the combined harvest rates in the Fisheries Management and Evaluation Plan (FMEP), Columbia River Fish Management Plan (CRFMP), and ocean fisheries are reviewed annually in the North of Falcon process. The U.S. v Oregon Technical Advisory Committee (TAC) has prepared Biological Assessments (BAs) for combined fisheries based on relevant U.S. v Oregon management plans and agreements. The current BA concerns Columbia River treaty Indian and non-Indian fisheries, as described in the "2008–2017 U.S. v Oregon Management Agreement for upriver Chinook, sockeye, steelhead, coho, and white sturgeon" (2008–2017 MA).

Hatchery coho can contribute significantly to the lower Columbia River gill net fishery. Commercial harvest of late-returning (Type-N) coho is focused in October during the peak abundance of hatchery-origin Type-N coho. A substantial estuary sport fishery exists between Buoy 10 and the Astoria-Megler Bridge.

3.3.1 Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Table 3.3.1.1: Cowlitz River Hatchery North Type Coho Fishery Contributions.

Brood Years: 2000-2009 Fishery Years: 2003-2012		
	Average SAR%[a]	**0.75**
Agency	***Non-WA Fishery***	***% of total Survival***
ADFG	All	*0.02*
CDFO	All	*1.65*
CDFW	All	*0.05*
NWFSC	All	*0.00*
Agency	***OR Fishery***	***% of total Survival***
ODFW	10- Ocean Troll	*0.86*
ODFW	21- Columbia R. Gillnet	*12.04*
ODFW	40- Ocean Sport	*14.86*
ODFW	44- Columbia R. Sport	*0.59*
ODFW	45- Estuarine Sport	*1.75*
ODFW	61- Test Fishery Net	*0.02*
ODFW	72- Juvenile Sampling - Seine (Marine)	*0.09*
Agency	***WA Fishery***	***% of total Survival***
WDFW	10- Ocean Troll	*0.62*

MAKA	15- Treaty Troll	*0.23*
WDFW	15- Treaty Troll	*0.33*
QDNR	22- Coastal Gillnet	*0.01*
WDFW	22- Coastal Gillnet	*0.50*
WDFW	23- PS Net	*0.04*
WDFW	40- Ocean Sport	*0.08*
WDFW	41- Ocean Sport- Charter	*10.51*
WDFW	42- Ocean Sport- Private	*17.72*
WDFW	43- Sport (Jetty)	*0.01*
WDFW	45- Estuarine Sport	*0.66*
WDFW	46- Freshwater Sport[b]	*5.47*
WDFW	50- Hatchery Escapement	*31.60*
WDFW	50- Hatchery Escapement (Strays)[c]	*0.15*
	Total	***100.00***

Source: RMIS 2014.

[a] Average SAR% = (tags recovered/tags released).

[b] Freshwater Sport based on WDFW Catch Record Card (CRC) data.

[c] Includes recoveries at Kalama Falls, Merwin, Minter Creek, North Toutle and Salmon River Hatcheries.

FOC and CG&A RSI programs: Fish released from the RSI programs are not marked in any way to contribute to harvest objectives. Any adults produced from this program would be protected by harvest rules on natural-origin coho. There is no sport salmon harvest in tributary creeks.

3.4 Relationship to habitat protection and recovery strategies.

The impact associated with Tacoma Power's and Lewis PUD's continued operation of hydroelectric facilities including the dams creating Mayfield Lake, Riffe Lake and Lake Scanewa are major factors that affected natural production of resident and anadromous fish species. Project impacts to fish include:

(1) Impacts to resident and anadromous fishes in the reservoirs, downstream, and upstream caused by project-related barriers, false attraction, entrainment in intakes, and other impediments to fish migration.
(2) Impacts to resident and anadromous fishes in the reservoirs, downstream, and upstream caused by project-related mitigation hatchery fish interactions with remaining wild fish.
(3) Impacts to resident and anadromous fishes in reservoirs from fluctuations in reservoir level.
(4) Impacts to resident and anadromous fishes downstream of the dams caused by project-related flow-dependent habitat changes.
(5) Impacts to resident and anadromous fishes downstream of the dams caused by project-related flow fluctuations.
(6) Impacts to resident and anadromous fishes in the reservoir and downstream caused by project-related channel changes stemming from alteration of natural sediment transport.
(7) Changes in dynamics of fish-predator interactions resulting from change in fish escape options.
(8) Changes in water quality (e.g., temperature, dissolved gases, suspended sediment, pollutants) which can impact fish (and wildlife).
(9) Interruption of the transport of large wood and nutrients from upstream to downstream reaches and nutrient transport upstream in the form of adult anadromous fish.
(10) Inundation of anadromous fish spawning, incubation, and rearing habitat by Mayfield, Mossyrock and Cowlitz Falls dams, resulting in loss of anadromous fish production from the inundated reaches.

Several FERC Settlement Agreement articles address passage problems in the system including: 1) Downstream Fish Passage for Riffe Lake and Cowlitz Falls; 2) Downstream passage for Mayfield Lake; and 3) Upstream Fish Passage for the Barrier Dam, Mossyrock and Mayfield. The articles also deal with future proposals and improvement needed for restoring processes upstream and down. A fish habitat fund of up to $3 million for identified projects in the lower Cowlitz River has been created (Article 11). In addition, a fish habitat fund of $15 million for identified projects in the upper Cowlitz River basin has been created (Article 3) in case further efforts towards volitional upstream passage are suspended for the current license period.

Additional Processes:
The following processes have included habitat identification problems, priority fixes and evolved as key components to The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, LCFRB 2010) and Lower Columbia River Salmon and Steelhead ESA Recovery Plan (Dornbusch and Sihler 2013)).

Sub-Basin Planning - Regional sub-basin planning processes include the Cowlitz River Sub-basin Salmon and Steelhead Production Plan, September 1, 1990 with a more recent Draft Cowlitz River Sub-basin Summary (May 17, 2002) was prepared for the Northwest Power Planning Council. The Sub-basin efforts provided initial building blocks for the LCFRB regional recovery plan. The Lower Columbia fish Recovery Board (LCFRB) has adopted The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004, revised June 6, 2010) with the understanding that Implementation of the schedule and actions for local jurisdictions depends upon funding and other resources.

Habitat Treatment and Protection - Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. EDT has been modeled for productivity in the Cowlitz basin in the *Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans,* and has been used by Tacoma Power for the FERC re-licensing agreements for the upper basin productivity goals. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP), which documents barriers to fish passage. WDFW's Habitat Program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Limiting Factors Analysis (LFA) - A WRIA 26 LFA was conducted by the Washington State Conservation Commission (May 2002). WRIA 26 was separated into seven sub-basins; Coweeman, lower Cowlitz, Toutle, Mayfield/Tilton, Riffe Lake, Cispus, and upper Cowlitz.

3.5 Ecological interactions.

(1) *Salmonid and non-salmonid fishes or species that could negatively impact the program:* Out migrant hatchery fish can be preyed upon through the entire migration corridor from the river sub-basin to the mainstem Columbia River and estuary. Northern pikeminnows and introduced spiny rays, as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons in the Columbia mainstem sloughs, can prey on steelhead smolts. Mammals that can take a heavy toll on migrating smolts and returning adults include: harbor seals, sea lions, river otters and orcas

(2) *Salmonid and non-salmonid fishes or species that could be negatively impacted by the program:* Co-occurring natural salmon and steelhead populations in local tributary areas and the Columbia River mainstem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run Chinook salmon ESU (threatened); Snake River spring/summer-run Chinook salmon ESU (threatened); Lower Columbia River Chinook salmon ESU (threatened); Upper Columbia River spring-run Chinook salmon ESU (endangered); Columbia River chum

salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). Listed fish can be impacted through a complex web of short and long term processes and over multiple time periods which makes evaluation of this a net effect difficult. WDFW is unaware of studies directly evaluating adverse ecological effects to listed salmon. In addition the program may have unknown impacts on eulachon populations in the basin.

(3) *Salmonid and non-salmonid fishes or other species that could positively impact the program.* Multiple programs including fall Chinook, coho and steelhead programs are released from the Cowlitz Salmon Hatchery and limited natural production of Chinook, coho, chum and steelhead occurs in this system along with non-salmonid fishes (sculpins, lampreys and sucker etc.).

(4) *Salmonid and non-salmonid fishes or species that could be positively impacted by the program.* Steelhead smolts can be preyed upon release thru the entire migration corridor from the river sub-basin to the mainstem Columbia River and estuary. Northern pikeminnows and introduced spiny rays in the Columbia mainstem sloughs can prey on steelhead smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Mammals that benefit from migrating smolts and returning adults include: harbor seals, sea lions, river otters and orcas. Except for yearling coho and steelhead, these species may serve as prey items during the emigration through the basin. Hatchery fish provide an additional food source to natural predators that might otherwise consume listed fish and may overwhelm established predators providing a beneficial, protective effect to co-occurring wild fish. Hatchery releases can also behaviorally encourage mass emigration of multiple species through the watershed, reducing residency. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmonids have been found to elevate stream productivity through several pathways, including:

a) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998);
b) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and
c) Juvenile salmonids have been observed to feed directly on carcasses (Bilby et al. 1996).

4 SECTION 4. WATER SOURCE

4.1 Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Table 4.1.1: Water sources at Cowlitz Salmon Hatchery.

Water Source	Water Right		Available Water Flow	Avg Water Temp (ºC)	Usage	Limitations
	Record/Cert. No.	Permit No.				
Well	G2-*08829CWRIS/ 06699	08197	2,060 gpm	6-9	Incubation/ early rearing	None
Well	G2-*8830CWRIS/ 06700	08198	2,860 gpm			
Cowlitz R. (surface)	S2-*19889CWRIS/ 10450	14724	200 cfs	4-13	Hatchery supply	BKD, IHNV, *C. shasta*

Source: Phinney 2006, WDOE Water Resources Explorer 2014, WDFW Hatchery Data.

Cowlitz Salmon Hatchery (CSH): CSH is supplied from three sources. The majority of water is supplied from the Cowlitz River, with a maximum of 75,000 gallons per minute (gpm) available to the rearing ponds. An additional 15,000 gpm is available for the fish separator and ladder. The other two sources are "C-wells" (1,000 gpm) and "PW–wells"(700 gpm). The wells are used between August and July, normally for egg incubation and early fry rearing. The temperature of water supplied to the Cowlitz Salmon Hatchery ranged from 4° to 13°C for river water, and from about 6° to 9°C for the groundwater (Harza 1997a in FERC 2001). An additional water right of 8 cfs was obtained for the BPA funded Stress Relief Ponds (SRP) for utilization with the upper Cowlitz River Restoration Project. Stress relief ponds have an alarm at the head box.

The primary concern during incubation is *Saprolegniasis* (fungus), which requires daily formalin treatments at 1:600 for 15 minutes. Excessive gas in the incubation effluent is variable and may be associated with periodic increases in yolk coagulation in eggs and fry. Supersaturated nitrogen gas conditions during high water necessitate the use of the denitrofication tower system. Water flow to fry is kept below 6 gpm to reduce or eliminate Bacterial Cold Water Disease (BCWD). A fish pathologist routinely checks for Infectious Hematopoeitic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD). All equipment in the rearing ponds is sanitized with a disinfectant solution after each use.

The water right permit for CSH formalized through the Washington Department of Ecology (see **Table 4.1.1** and was obtained by Tacoma Power in 1966 (surface) and 1967 (wells).

FOC and CG&A RSI programs: The RSI programs operate in the streams from January to April. Individual tributary water flow data is not available, but by mid-winter most creek in-stream flows have been recharged throughout the system. The RSI sites have been located in areas where conditions for successful short-term incubation.

From December 1 to April 1, average water temperatures the system can system range from 3.3° to 8.5°C (37.9 – 47.3°F) (WDOE Coweeman River gauge). Coho fry disperse and rear in the system until they out-migrate the following year. Both in-stream flow and elevated water temperatures during the summer months are limiting factors for many lower Cowlitz River tributaries. Water temperatures may exceed 16°C during July and August, and sometimes reach near lethal temperatures for salmonids (23-25°C). NOAA has indicated that water temperatures above 15 to 17.8°C are rated as poor for salmon. Reeves et al. (1989) indicated that minimum which water temperatures exceed 20°C for two weeks or more are detrimental to summer coho salmon parr production. Water quality, especially high water temperatures, was identified as a major limiting factor throughout WRIA 26.

NPDES Permits.
CSH: This facility operates under the *"Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System* (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE) (see **Table 4.2.1).**

Discharges from the cleaning treatment system are monitored as follows:

- *Total Suspended Solids (TSS)* 1 to 2 times per month on composite effluent, maximum effluent and influent samples.
- *Settleable Solids (SS)* 1 to 2 times per week on effluent and influent samples.
- *In-hatchery Water Temperature* - daily maximum and minimum readings.

Table 4.1.1: Record of NPDES permit compliance at Cowlitz Salmon Hatchery.

Facility/ Permit #	Reports Submitted Y/N			Last Inspection Date	Violations Last 5 yrs (see list)	Corrective Actions Y/N	Meets Compliance Y/N
	Monthly	Qtrly	Annual				
CSH WAG13-1021	Y	Y	Y	3/6/2013	0	N	Y

Source: Ann West, WDFW Hatcheries Headquarters Database 2014.

FOC and CG&A RSI programs: Fish produced from these programs are released unfed, and are therefore <20,000 lbs and < 5,000 lbs of fish feed per month; therefore, these programs do not require an "*Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System* (NPDES) general permit.

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Cowlitz Salmon Hatchery: Intake and screen criteria are in compliance with state and federal guidelines (NOAA-NMFS 1995, 1996), but do not meet the current Anadromous Salmonid Passage Facility Design criteria (NOAA-NMFS 2011). This assessment is based on structural components and the hydraulics of the intake by WDFW (November 16, 2004 Intake Assessment, Cowlitz Salmon Hatchery, Ray Berg, Lead Project Engineer). Velocity through intake screens, sweep velocity, mesh openings and juvenile bypass from screens do not meet criteria.

During the facilities renovation (completed in 2010), major modification of the intakes at Cowlitz Salmon or Cowlitz Trout Hatcheries were not made by Tacoma Power because of the uncertainty over the potential breaching of the Barrier Dam. The water diversion and pump intakes at the salmon hatchery do not have adequate screens and may also pose a potential risk to naturally produced Chinook. Currently, the diversion and water intake structure for the Cowlitz Salmon Hatchery is adjacent to and immediately upstream of the Barrier Dam, and is not completely screened. There is some potential risk that some naturally produced fall Chinook juveniles could be taken should they enter this structure. Tacoma Power is investigating the intake to see if reasonable measures could result in improvements.

FOC and CG&A RSI programs: RSI sites have been chosen that provide a consistent source of water with minimal siltation problems. Water intake pipes are screened to prevent debris or fish from entering the incubator. Loadings into the bucket RSIs are less than 50% of capacity therefore reducing risk of dead eggs potentially spreading fungal problems to adjacent healthy eggs. Dead eggs or hatched fry can be removed and are disposed to prevent transmission through the discharge pipe. RSIs are checked regularly or more if needed due to significant rain events.

5 SECTION 5. FACILITIES

5.1 Broodstock collection facilities (or methods).

The adult collection facility at the Cowlitz Salmon Hatchery consists of the Barrier Dam (constructed in 1969) across the river (length of 318') and an associated fish ladder. The Barrier Dam directs migrating adult fish to the fish ladder which leads to the salmon hatchery sorting facilities. There are right and left bank entrances to the fish ladder and an under spillway transport channel connecting the two ladder entrances. Fish move up the ladder to the sorting, transfer and holding facilities. Since construction neither the transport channel nor the left bank entrance are in use because of design problems with the attraction flow. There is also an electrical field at Barrier Dam to aid in blocking fish. Adults can be sorted to holding ponds or also held in one of six circular tanks if they are to be transported. The adults can also be transferred to a number of other ponds including nine concrete ponds (80' x 15' x 6') via transfer tubes.

5.2 Fish transportation equipment (description of pen, tank truck, or container used).

Table 5.2.1: Transportation equipment available at Cowlitz Salmon Hatchery.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Average Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Tanker Truck	1,500	Y	N	See below	Sodium chloride (Salt)	5,000 ppm (~0.5%)
Tanker Truck	750	Y	N	See below	Sodium chloride (Salt)	5,000 ppm (~0.5%)
Tanker Truck	100	Y	N	See below	Sodium chloride (Salt)	5,000 ppm (~0.5%)
Tanker Truck	250	Y	N	See below	Sodium chloride (Salt)	5,000 ppm (~0.5%)

Adult and juvenile fish are held in one of six 643 cubic feet circular tanks at the adult trap and separator before transport from the fish separation unit. Three 1,500 gallon tanker trucks are capable of hooking to the underside of the circular tanks and receiving fish through water displacement, which results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river.

In addition, several smaller tankers with air stones (one 750 gallon, one 1,000 gallon, one 1,500 gallon and several 250 gallon tanks) are utilized for moving fish around the facilities, or to the upper basin. Adult upriver hauls can take up to one hour.

Eggs are incubated to eyed stage at Cowlitz Salmon Hatchery. Eggs develop to the eyed stage by early-February, depending on water temperatures of egg-take dates. Enhancement co-op volunteers and staff will arrange to pick up egg allotments and transport eyed eggs in wet burlap sacks via personal vehicles to the multiple RSI sites.

5.3 Broodstock holding and spawning facilities.

Table 5.3.1: Adult holding/spawning facilities available at Cowlitz Salmon Hatchery.

Ponds (number)	Pond Type	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
6	Circular Separator Tanks	643	13.5	-	-	800
9	Concrete Ponds	7,200	80	15	6.0	2,500

Cowlitz Salmon Hatchery. Adults are separated to the following ponds for holding or transfer. The circular tanks are designed to hold up to 1,250 pounds of fish.

FOC and CG&A RSI sites. Eggs are incubated at the Cowlitz Salmon Hatchery in vertical stack incubators to the eyed-egg stage. The programs use modified 5-gallon buckets for most of the program, and older Heath Techna vertical incubators (previously used at Cowlitz Salmon Hatchery before renovation – completed 2010). See also HGMP section 9.1.4.

5.4 Incubation facilities.

Table 5.4.1: Incubation vessels available at Cowlitz Salmon Hatchery.

Type	Units (number)	Flow (gpm)	Volume (cu. ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Vertical stack units (16 trays/ Stack Unit)	160 (2,560 trays)	12 gpm on 4 units-		7,000	7,000
Free style deep isolation incubators	8 units	24 gpm all units		250,000 - 300,000[a]	
Vertical stack units (16 trays/Stack Unit) Recirculation Systems A&B	36 Stacks (288 trays)	3-5	-	10,000[b]	10,000[b]

[a] Green egg stage only

[b] Steelhead and cutthroat

There are 160 stacks of vertical incubators. Each stack consists of 16 trays which are divided into two half-stacks of eight trays with separate water supplies at 4 gpm (to hatching). Fry are incubated at 4 gpm (to ponding) and confined in Vexar® substrate to discourage excessive swimming and to provide the hatched salmon fry with a tactile environment prior to swim-up.

5.5 Rearing facilities.

Table 5.5.1: Rearing ponds available at Cowlitz Salmon Hatchery.

Ponds (No.)	Pond Type	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
36	California Style Raceways	11,000	200	10	5.5	2,500	1.61	0.3
1	Concrete Backwash Kettle	8,000	200	5	8.0	50		
12	BPA Concrete Raceway	1,260	45	8	3.5	250	1.61	0.3

In addition, twelve BPA stress relief ponds and two starter vessels were added to this facility in 1996 to assist the Upper Cowlitz River Reintroduction Program.

5.6 Acclimation/release facilities.

CSH: Releases are from rearing ponds (see HGMP section 5.5) discharging into the Cowlitz River downstream of the Barrier Dam via volitional release pipe. Smolts are collected at the Cowlitz Falls Fish Facility (CFFF) are trucked below the dams and released at RM 49 from twelve stress-relief raceways located at the CSH. These raceways were constructed as part of the reintroduction and restoration effort and were designed to allow a time period for recovery (up to 48 hours), and volitional release. Smolts collected at the facility include naturally-produced smolts from natural-origin and hatchery adults that spawned in the upper watershed.

Upper river smolt releases: The upper Cowlitz Falls Dam presents a barrier which impedes or prevents downstream migration of smolts from the upper Cowlitz. However, the dam includes a juvenile fish collection facility, with smolts taken to the CSH stress relief ponds until fish have acclimated before release.

FOC and CG&A RSI projects: RSIs are used only to rear fish to the swim-up fry stage. Subsequently, fry rear naturally to the yearling stage within the tributary or Cowlitz River mainstem.

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

CSH: Generally, no physical operational difficulties have been experienced. Pathogen outbreaks of *Ceratomyxa shasta* at the Cowlitz Salmon Hatchery and IHNV and *C. shasta* at Cowlitz Trout Hatchery have chronically caused some significant fish mortality in Chinook and steelhead in the past. Installation of an ozone treatment facility at the Cowlitz Trout Hatchery in 1991 has decreased mortality significantly.

FOC and CG&A RSI projects: RSIs are used only to rear fish to the swim-up fry stage. Subsequently, fry rear naturally to the yearling stage within the tributary or Cowlitz River mainstem.

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

CSH: During trapping season, tanker trucks are capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to any listed adult fish.

The hatchery has two back-up generators located in separate sheds and one backup generator in the basement for the recirculation systems and sump pumps installed during the remodel of the hatchery. The 1.5 KBW generator with upgraded switching equipment is capable of supplying power with sufficient capacity. One of these generators has sufficient capacity to operate the two-200 hp pumps and two of the 600-HP pumps along with the residences in the event of a power outage. Tacoma Power has retained the 600-KW generator and switching equipment which would bring on one river pump in case the new generator should ever fail. Tacoma Power staff maintains the facility and Tacoma Power and the WDFW staff test the emergency systems weekly. In event of system failure, there is an extensive alarm system capable of identifying problems in critical areas of the hatchery and on-station WDFW staff will respond to these alarms 24/7 with assistance from Tacoma Power staff if necessary. A river water supply shunt valve was installed in 1999 to bypass the de-nitrification columns to provide water during the time the auxiliary power is being used. During the remodel of the hatchery a larger river water supply valve was also installed off of the primary ring header supply line to provide more water down to the SRs if needed.

FOC and CG&A RSI projects:

- Program uses multiple locations in the same system.
- RSI sites have been chosen that provide a consistent source of water with minimal siltation problems.
- Water intake pipes are screened to prevent debris or fish from entering the incubator.
- Loadings into the RSIs are less than 50% of capacity therefore reducing risk of dead eggs potentially spreading fungal problems to adjacent healthy eggs.
- Dead eggs or hatched fry can be removed and are disposed to prevent transmission of diseases.
- RSIs are checked regularly or more if needed due to significant rain events.

6 SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1 Source.

Adults and jacks returning to and trapped at the Cowlitz Salmon Hatchery trap and separator facility.

6.2 Supporting information.

6.2.1 History.

Cowlitz coho were identified as a stock based on their distinct spawning distribution, run timing and genetic composition. Naturally spawning Cowlitz coho are a composite stock influenced by hatchery releases that began in 1915.

Late coho (Type-N) are informally considered synonymous with Cowlitz River stock coho, characterized by late run timing and a northern migration route in the ocean after leaving the Columbia River. Columbia River late stock hatchery programs were developed from the Cowlitz River stock, their derivatives or native runs. All naturally-produced, unmarked fish collected at the Cowlitz Salmon Hatchery trap above broodstock needs are passed upstream of Mayfield Dam along with surplus hatchery fish to spawn naturally. Most spawning below Mayfield Dam takes place in the mainstem Cowlitz. Broodstock are collected from adults returning September through February.

Hatchery-origin Cowlitz River Type-N coho releases began in 1969 to present.

6.2.2 Annual size.

At the current program size, the number of broodstock collected is approximately 1,537 adults at a female to male ratio of 1:1. Up to 2% of the male component is made up of jacks (approximately 30).

Approximately 83 pair are used to secure the 40,000 and 230,000 eyed eggs needed for the CG&A and FOC programs, respectively, based on an average fecundity of 3,800 eggs/female.

6.2.3 Past and proposed level of natural fish in broodstock.

Past levels of natural fish in the broodstock is unknown. Hatchery coho have been planted in the Cowlitz since at least 1915; the first hatchery releases were from Tilton River Hatchery, which operated downstream of Morton until 1921. Stock mixing probably began around this time (DeVore 1987).

6.2.4 Genetic or ecological differences.

Historically, two separate runs of coho salmon were observed in the Cowlitz River. The early run (Type-S) entered the Cowlitz from late August and September, with a spawning peak in late October. The late run (Type-N) entered the Cowlitz from October through March, with a spawning peak in late November (WDF and WFC 1948, as cited in Dammers et al. 2002). Most coho in the Cowlitz Basin are of hatchery-origin. DeVore (1987) examined the 1982 brood hatchery release and concluded wild/natural production was minor.

Broodstock for this program is provided by coho destined for areas above the Mayfield Dam. The broodstock is a combination of all populations that occurred above the dam, including both early-timed and later-timed run coho. Coho releases from outside the basin have been minimal. The Cowlitz hatchery coho stock is considered representative of the upper and lower historical populations under NOAA's proposed listing determination (69 FR 33102; 6/14/2004).

6.2.5 Reasons for choosing.

Hatchery coho were derived from the local population, and are representative of the natural-origin population. While the Cowlitz River coho are managed for a large range of return timing, the later "Type-N" stock returns after the fall Chinook season, so their harvest in the Columbia River gill-net fishery was not affected by Chinook conservation efforts. The Type-N stock has dominated Cowlitz hatchery production because catch distribution favors the Washington ocean fishery rather than the fisheries south of the Columbia River (WDW 1990).

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

Broodstock are selected over a wide range of coho escapement back to the hatchery to best represent the historical timing of the run. Eggs are taken from three time periods with the first group made up of adults arriving late-September through mid-October (45% of the yearling release). The middle group is made up of adults arriving during from mid-October through late-November (45% of the yearling release). The late group returns to the hatchery from late-November through February. Progeny from "late" arriving adults have historically been only 10% of the yearling release. Coop eggs are also taken from the late group returns. The integrated program broodstock are also collected during the time frames of the hatchery broodstock to represent the entire run.

7 SECTION 7. BROODSTOCK COLLECTION

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

Adults returning to Cowlitz Salmon Hatchery.

7.2 Collection or sampling design.

At the base of the Barrier Dam (designed to stop/reduce all adult fish migration upstream) is a fish ladder leading to a trap and a fish separator. Adults can be sorted/separated into appropriate ponds for holding until spawned.

Collection for coho broodstock is taken from three time periods. The early group was made up of adults arriving from late-September through mid-October (45% of the yearling release). The middle group is made up of adults arriving during from mid-October through late-November (45% of the yearling release). The late group returns to the hatchery from late-November into February. Progeny from "late" arriving adults have historically been only 10% of the yearling release.

7.3 Identity.

Segregated program. All fish are hand sorted at the Cowlitz Salmon Hatchery separator and only hatchery-identified fish (ad clip, no CWT) of the appropriate time and number are retained for spawning use.

Integrated program. All fish are hand sorted at the Cowlitz Salmon Hatchery separator. Integrated fish are identified by an adipose clip and coded wire tag. The integrated fish are shipped upstream with the wild unmarked fish. Broodstock is collected from both the wild, and integrated fish (F1s) if necessary,

Although on-station releases from Cowlitz Salmon Hatchery are mass-marked, RSI program fry releases are not marked.

7.4 Proposed number to be collected:

7.4.1 Program goal (assuming 1:1 sex ratio for adults):

Segregated program. A total of 1,549 males, 1,520 females and 81 jacks were collected for brood stock before 2008. After the remodel the brood stock collection numbers went down to a total of 406 males, 407 females and 41 jacks a total of 813 adult fish for the segregated program. The average egg fecundity of coho females for the 2012 brood was 3,847-eggs/per female.

Integrated program. After the remodel the brood stock collection numbers for the integrated program totaled of 363 males, 361 females and 36 jacks a total of 724 adult fish for the integrated program. The average egg fecundity of coho females for the 2012 brood was 3,976-eggs/per female.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Table 7.4.2.1: Total broodstock collected by sex and mark type from 2001-2013.

Year	Marked			Unmarked		
	Males	Females	Jacks	Males	Females	Jacks
2001	2165	1962	34	-	-	-
2002	1313	1360	45	-	-	-
2003	1123	1185	28	-	-	-
2004	1129	1174	20	-	-	-
2005	1098	1170	31	-	-	-
2006	1024	1037	15	-	-	-

2007	861	899	35	153	172	7
2008	521	551	29	257	272	23
2009	663	687	14	339	337	6
2010	285	315	20	272	291	7
2011	451	473	14	313	318	5
2012	381	453	13	214	266	9
2013*	726	797	31	2	0	0

Source: WDFW Hatcheries Headquarters Database 2014.

* Integrated coho brood stock (F1s) were crossed with wild brood stock adults in the 2013 brood year. A total of 354 females, 316 males and 10 jacks were spawned with 2 NOR fish. This was due to a lack of available natural-origin adults.

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Adult coho that return to the Cowlitz Salmon Hatchery separator are sorted and those fish designated for the upper watershed are placed in holding tanks. All NOR adults of upper Cowlitz origin and up to 25,000 integrated adults (F1s) above hatchery broodstock needs are transported above Cowlitz Falls Dam to Lake Scanewa, Cispus River or the Cowlitz River at Packwood to enhance spawner distribution and recreational angling opportunity at those locations. Up to 6,000 adults of combined NOR (Tilton origin) and HOR above hatchery broodstock needs are transported to the Tilton River. Additional HOR adults above broodstock needs are donated to the food banks and tribes or used for nutrient enhancement. Fish are transported and released by Tacoma Power. Along with fall Chinook, spring Chinook and steelhead, the trap and haul program has re-established some anadromous salmonid production in the upper Cowlitz River basin and has been most successful with coho salmon. Under the FHMP, up to 25,000 adults from the integrated program and natural-origin fish (NOR) of upper Cowlitz origin will be placed upstream until a trigger of 60% fish passage survival is achieved with current survival under 40%. More than 637,000 hatchery coho adults have been hauled upstream since 1967 (see also **Tables 2.2.2.12 and 2.2.2.13)**.

7.6 Fish transportation and holding methods.

Fish used for broodstock are held in ponds that are 15' X 80' X 6' or in the circular separator tanks if needed. They can be transferred to the spawning room where they can be checked for ripeness and anesthetized and spawned, or (if not ripe) returned to a holding pond via a return tube.

See also HGMP section 5.2.

7.7 Describe fish health maintenance and sanitation procedures applied.

Broodstock can be inoculated with antibiotics for furunculosis and treated with formalin at 1:6,000 for fungus and parasite control. All equipment used for broodstock collection is sanitized using a disinfectant solution.

The adult holding area is separated from all other hatchery operations. All equipment and personnel use disinfection (Virkon®) procedures upon entering or exiting the area. Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning. Spawning implements are rinsed with an iodophor solution, and spawning area and implements are disinfected with iodophor solution at the end the spawning day.

7.8 Disposition of carcasses.

Prior to 1999 brood year, all spawned carcasses and mortalities were buried at a Tacoma Power upland site. Beginning with 1999 brood coho, spawned and un-spawned carcasses were distributed upstream of the salmon hatchery for nutrient enhancement if not inoculated with antibiotics for fish pathogens. High quality fish are also distributed to the statewide food bank, local food banks and tribes (primarily Cowlitz and Yakama tribes).

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

The program has guidelines for acceptable contribution of hatchery fish to natural spawning. **See HGMP Section 7.5.**

8 SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1 Selection method.

Segregated program. Broodstock are selected over a wide range of coho escapement back to the hatchery to best represent the historical timing of the run. Eggs are taken from three time periods with the first group made up of adults arriving late-September through mid-October (45% of the yearling release). The middle group is made up of adults arriving during from mid-October through late-November (45% of the yearling release). The late group returns to the hatchery from late-November into February. Progeny from "late" arriving adults have historically been only 10% of the yearling release.

Integrated program. Integrated fish are identified by an adipose clip and coded wire tag. The integrated fish are shipped to the upper Cowlitz with the wild unmarked fish. Broodstock is collected from wild returns of upper Cowlitz origin, and if necessary the integrated (F1s) for the integrated hatchery program, collected during the same time frame as the segregated program.

8.2 Males.

Males and females available on a given day are mated randomly. Males are usually used once except when too few males per ripe females occurs, then they are live-spawned and returned to pond with a caudal clip for identification (occasionally occurs at the first and last spawning).

8.3 Fertilization.

Coho are spawned at a 1:1 ratio, eggs are fertilized and then 2 females are pooled into one incubation tray.

8.4 Cryopreserved gametes.

Cryopreserved gametes are not used.

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

- Only Cowlitz local broodstock will be used.
- Wild unmarked fish will be used for integrated programs. If needed to meet program goals and wild fish are not abundant then integrated brood stock will be used to cross with the wild fish. Males and females available on a given day are mated randomly.
- After fertilization eggs from each pool of females is disinfected and water hardened in an iodine solution for one hour.
- Every season, 60 ovarian fluid samples are taken to check for IHNV.
- Hands and spawning implements are rinsed in an iodophor solution between individual spawnings.

9 SECTION 9. INCUBATION AND REARING -Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1 Incubation:

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

Table 9.1.1.1: Survival rates (%) from egg-take to ponding, Cowlitz River Type-N coho.

Year	Egg-Take	% Survival	
		Green-to-Eyed Eggs	Eyed Egg-to-Ponding
2001	6,819,786	96.3	94.6
2002	5,488,600	95.6	96.4
2003	4,328,600	96.5	97.9
2004	4,350,600	93.7	96.4
2005	4,273,100	95.0	97.5
2006	4,298,700	94.4	96.5
2007*	3,634,150	94.5	97.7
2008*	3,550,400	94.7	97.4
2009*	3,638,200	95.1	97.8
2010*	2,487,000	95.0	97.6
2011*	2,902,200	95.5	97.7
2012*	2,402,300	94.5	97.6
2013*	2,843,100	93.1	97.4
Average	**3,924,364**	**94.9**	**97.1**

Source: WDFW Hatcheries Headquarters Database 2014.
* Combined segregated and integrated programs.

Cowlitz Salmon Hatchery egg-take goal is approximately 2.9-million. A total of 270,000 eyed-eggs are transferred to enhancement co-op RSI programs. Both Friends of the Cowlitz and Cowlitz Game and Anglers report high survival rates of 98% or better from picked loss through the eyed-egg stage and from post release monitoring of loss within the RSI.

Table 9.1.1.2: Cowlitz Salmon Hatchery Type-N coho eyed-eggs transferred to regional co-operative programs, by brood year.

Brood Year	Eggs Transferred		
	FOC	CG&A	Reg 5 Ed Co-ops
2002	195,600	57,000	1,300
2003	140,000	40,000	1,150
2004	200,050	40,000	1,250
2005	200,000	40,000	3,850
2006	201,400	40,717	1,100
2007	235,000	40,000	850
2008	230,000	40,000	1,000
2009	230,550	40,000	850
2010	226,116	40,000	1,000
2011	230,000	40,000	600
2012	58,250	10,150	600

Source: WDFW Hatcheries Headquarters Database 2014.

9.1.2 Cause for, and disposition of surplus egg takes.

In cases where egg survival exceeds criteria and/or surplus eggs are taken, fish would be out-planted as unfed fry into the upper Cowlitz sub-basin/tributaries or provided to cooperative programs.

9.1.3 Loading densities applied during incubation.

Cowlitz Salmon Hatchery: Vertical incubators are used from egg take through button-up. After eye-up, eggs are picked and loaded at 8,000 eggs per tray. Eggs are incubated with 4 gpm to conserve well water while fry are incubated at 4 gpm and confined in Vexar® substrate to discourage excessive swimming. In recent years, coho eggs are typically 1,800 to 2,000 per pound. Freestyle egg boxes may also be used up to the eyed egg stage to conserve water and chemical use, 250,000 to 300,000 eggs may be eyed up in these boxes.

FOC and CG&A RSI programs: Stacks of incubator trays will be plumbed with PVC piping to provide water flows of 5-gpm through the trays and can accommodate up to 8,000 eggs each, though loadings are reduced per tray to allow more space.

Each 5-gallon bucket can safely accommodate up to 5,000 eggs.

9.1.4 Incubation conditions.

Cowlitz Salmon Hatchery: After eyeing and picking of the eggs, a second picking of fry is done after hatch is completed and substrate is placed in the trays with the hatched fry, the Vexar® substrate is placed into the tray to promote healthier, larger and more uniform fry development. Typically, influent water flow to top tray is 11 parts per million (ppm), and effluent water (bottom tray) is ~9 ppm at <10°C (50°F). Influent total gas continues to be variable and is sometimes unacceptably high depending upon well and other water sources. Total gas in influent water in the header trough has exceeded 113%, but influent water is typically above 100% saturation as measured by HARZA N.W. and the Cowlitz Hatchery crew.

Table 9.1.4.1: Date of Cowlitz Salmon Hatchery Type-N coho eyed-egg transfers to the enhancement co-op RSI projects.

Brood Year	Friends of the Cowlitz RSI	Cowlitz Game & Anglers RSI
2001	Jan 27; Mar 18	Feb 27
2002	Jan 30; Feb 12, 24, 28	Jan 24, Feb 22
2003	Jan 29; Feb 17	Jan 15
2004	Feb 11; Mar 1-8	Feb 9
2005	Jan 23, 30; Feb 4, 9, 22, 24	Jan 23
2006	Jan 22; Feb 1-2	Jan 18, 29
2007	Jan 23; Feb 1, 7, 15, 23	Jan 23
2008	Jan 26	Jan 26
2009	Feb 1, 9, 16	Feb 1
2010	Feb 4, 17; Mar 24	Jan 28
2011	Jan 27; Feb 3-4; Apr 5	Feb 7
2012	Jan 30; Feb 7, 14	Feb 3; Mar 18

Source: WDFW Hatcheries Headquarters Database 2014.

FOC and CG&A RSI sites: This program uses modified 5-gallon buckets for most of the program, although older vertical incubators (Heath Techna) previously used at Cowlitz Salmon Hatchery before renovation (2010) are used and incorporated into the RSI program. Stacks of incubator trays are plumbed with PVC piping to provide 5 gpm through the trays and accommodate up to 8,000 eggs each, although loadings will be reduced per tray and to allow more space. Stack incubators have a screened top and do not allow volitional release; swim-up fry are released manually.

Each 5-gallon bucket can safely accommodate up to 5,000 eggs. Water flows into the bucket through a flow diffuser about one inch from the bottom, and flows out of the bucket a few inches from the top, creating an upwelling of water through an artificial incubation substrate. Eggs are suspended on trays above the substrate. The bucket can be drained to clean sediment out without disturbing the eggs. Eyed-eggs hatch and disperse within the artificial substrate. Upon yolk absorption, fry move up through the substrate and exit volitionally through the outlet pipe.

9.1.5 Ponding.

Cowlitz Salmon Hatchery: Fry are ponded when less than 1 millimeter (mm) of yolk is showing. They typically have accumulated ~1,780 Temperature Units (TUs), are ~1,500 fish per pound (fpp) and are ~36 mm long. At the Cowlitz Salmon Hatchery these fish are usually ponded during February to May. Ponding is forced as Mari Source stack incubators do not lend themselves to volitional ponding of swim-up fry.

FOC and CG&A RSI programs: Swim-up fry egress the RSI incubators volitionally, to rear naturally in the tributaries or mainstem Cowlitz River. Fry from the stack incubators need to be manually released to stream.

9.1.6 Fish health maintenance and monitoring.

Cowlitz Salmon Hatchery: Every season 60 ovarian fluid samples are taken to check for IHNV. Salmon fungus (*Saprolegnia* sp.) is the primary concern during incubation requiring daily treatments with formalin at 1:600 for 15 minutes. Water flow to fry below 6 gpm is known to reduce or eliminate Bacterial Cold Water Disease (BCWD) in the early life history of salmon in vertical incubators. While eggs are incubated at 4 gpm, fry are incubated at 4 gpm and confined in Vexar® after second picking of fry is completed; the substrate is placed in the trays with the hatched fry. The Vexar® substrate discourages excessive swimming and promotes healthier, larger and more uniform fry development.

Excessive gas in the incubation influent water is variable and appears to be associated with periodic increases in yolk coagulation in eggs and fry. In some years, coho are especially prone to fragmented yolk showing up with fry after hatching.

Mortality from iron bacteria in the past occurred in the water supply from PW-Well #3. The well was eliminated as a source of incubation water.

FOC and CG&A RSI programs: Prior to transfer to the RSI sites, CSH staff implement disinfection procedures during incubation to prevent pathogen transmission between fish stocks on site. Following eye-up stage, eggs are inventoried, and dead or undeveloped eggs are removed to prevent fungal infection. They are disposed of in a manner that prevents disease transmission to the receiving watershed.

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

IHOT and WDFW fish health guidelines followed.

- At about 500 temperature units, eyed eggs are resistant to shock, this is when they can be transported, handled and loaded into the incubators.
- Eyed eggs can survive loss of water for extended periods of time and if due to silt or high water problems can be drained of water and kept moist until water conditions allow continued operations.
- Eggs and alevin are protected from predators until the free swimming stage.
- An additional tray can be used to minimize silt or sediment problems.
- Egg loss is monitored and dead eggs are removed to prevent fungal spread from one egg to another.

9.2 Rearing:

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

Cowlitz Salmon Hatchery:

Table 9.2.1.1: Survival rates (%) from ponding to release, Cowlitz River Type-N Coho.

Year	Egg-Take	% Survival	
		Fry-to-Sub-yearling	Fry-to-Smolt
2001	6,819,786	95.1	93.0
2002	5,488,600	95.8	92.7
2003	4,328,600	96.1	94.0
2004	4,350,600	97.0	94.2
2005	4,273,100	96.9	94.9
2006	4,298,700	97.8	96.2
2007*	3,634,150	97.4	94.1
2008*	3,550,400	97.4	94.6
2009*	3,638,200	98.2	97.1
2010*	2,487,000	98.1	97.7
2011*	2,902,200	97.8	97.8
2012*	2,402,300	97.7	97.7
Average	**4,014,470**	**97.1**	**95.3**

Source: WDFW Annual Escapement Reports and Hatcheries Headquarters Database 2014 & Cowlitz Salmon Hatchery Annual Reports.

*Combined segregated and integrated programs.

FOC and CG&A RSI projects: Average success of incubating eyed eggs to swim-up fry in the RSI units is approximately 95% for the program (pers. Comm. Don Glaser 2004). See also HGMP section 1.12.

9.2.2 Density and loading criteria (goals and actual levels).

Cowlitz Salmon Hatchery: The goal for density and flow indices 0.30 lbs. Fish/cu. ft./in., and 1.00 lb. fish/gpm/in. (Article 7, FERC 2016). These parameters are typically exceeded in the final weeks of rearing.

FOC and CG&A RSI projects: Stacks of incubator trays are plumbed with PVC piping to provide 5-gpm water flow through the trays, which can accommodate up to 8,000 eggs each if needed; loadings are reduced per tray and allow more space. Each 5-gallon bucket can safely accommodate up to 5,000 eggs.

9.2.3 Fish rearing conditions

Cowlitz Salmon Hatchery: Rearing units are cleaned at least one time per week. Total gas and corresponding DOs have been extensively monitored by HARZA N.W., contractors with Tacoma Power.

FOC and CG&A RSI projects: After hatching, fish rear in the RSIs from the alevin to free-swimming stage. Eggs hatch from 400 to 500 temperature units (TU - daily degree unit above 32°F), and will take another 300 to 400 TUs to free-swim and egress from the RSI. If late-winter water temperatures range from 40-45°F, hatching will take 40-50 days, and swim-up will occur within another 30-40 days. Cowlitz Game and Anglers volunteers monitor flow and debris which can block flow through the water intakes.

9.2.4 Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Cowlitz Salmon Hatchery:

Table 9.2.4.1: Monthly fish growth information by length (mm), weight (fpp), condition factor and growth rate, collected during rearing.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate
March (Fry Ponding)	39.4	1,400	0.00035	-
April	45.0	850	0.00035	0.393
May	61.0	240	0.00035	0.718
June	81.5	100	0.00035	0.583
July	92.2	70	0.00035	0.300
August	97.0	60	0.00035	0.143
September	102.9	50	0.00035	0.167
October	110.5	40	0.00035	0.200
November	119.1	32	0.00035	0.200
December	127.8	26	0.00035	0.188
January	139.2	20	0.00035	0.231
February	144.3	18	0.00035	0.100
March	148.8	16	0.00035	0.083
April	153.4	15	0.00035	0.091

Source: WDFW hatchery data.

FOC and CG&A programs: Free-swimming coho fry average around 38-39 mm fork length (fl) and weigh about 0.4 grams (900 – 1,200 fish/lb). Subsequent growth to yearling smolt stage depends on water temperature and food availability.

Research from RSI projects on Snow and Andrews Creek located on the Olympic Peninsula indicate that coho fingerlings lengths reach 50 mm fl by mid-May and 60 mm fl by mid-June. Growth rates on RSI coho in the Lewis River system is dependent on water temperature and productivity is specific to individual tributaries. Larger coho trapped from mid-April to early-May indicate larger coho to be 85 to 105 mm fl.

9.2.5 Indicate monthly fish growth rate and energy reserve data (average program performance), if available.

See HGMP section 9.2.4.

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Cowlitz Salmon Hatchery: Fish are given variety of diet formulations including starter, crumbles and pellets; the food brand used may vary, depending on cost and vendor contracts. Feeding frequencies varies depending on the fish size and water temperature, and usually begin at 8 feedings/7 days a week, and end at 1 feeding/4 days a week. Feed rates vary from 1.0% to 3.0% B.W./day. The overall season feed conversion ratio has averaged approximately 1:1.

FOC and CG&A RSI projects: Fish are released as unfed fry.

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

Fish Health Monitoring: Fish health is monitored on a daily basis by hatchery staff and at least monthly by a WDFW Fish Health Specialist. Hatchery personnel carry out treatments prescribed by the Fish Health Specialist. Procedures are consistent with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006), *Fish Health Policy in the Columbia Basin* and *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Health Policy Chapter 5, IHOT 1995). A fish health specialist stationed at Cowlitz Complex inspects fish programs and checks both healthy and if present symptomatic fish. External signs such as lesions, discolorations, and fungal growths will lead to internal examinations of skin, gills and organs. Blood is checked for signs of anemia or other pathogens. Additional tests for virus or parasites are done if warranted.

Eggs are transferred within the Cowlitz River system and fall within fish and egg transfer policies. Eyed-eggs prior to transfer are picked for mortalities. Subsequent egg or alevin mortality is disposed of to prevent transmission to the stream.

Disease Treatment: In the standard ponds, fry and fingerlings have been treated with florfenicol for Bacterial Cold Water Disease (BCWD) and Parasite-S for external parasites, fungus and *Trichodina* control in adults. Infectious Hematopoietic Necrosis Virus (IHNV) from adults can cause low-level chronic mortalities during the rearing period. Erythrocytic Inclusion Body Syndrome (EIBS) has occurred in many years and predisposes fish to other diseases, fungal infections and BCWD, and frequently occurs concomitantly with these diseases. Formalin baths were also given after marking to prevent CWD and fungus from infecting the clipped area. Fish health and/or treatment reports are kept on file.

Sanitation: Mortalities are collected and disposed of at a landfill. All equipment (nets, tanks, boots, etc.) are disinfected with Virkon® between different fish/egg lots. Different fish/egg lots are physically isolated from each other by separate ponds or incubation unit, with the intent of preventing the horizontal spread of pathogens through splashing water. Tank trucks are disinfected between the fish transports. Foot baths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

After the program has concluded for the season, the RSIs are removed, cleaned, disinfected and dried.

See also HGMP section 10.9 for WDFW Standard Fish Health Procedures.

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

Organosomatic indexes were conducted by personnel from the WDF fish health section during late 1980s and early 1990s under BPA funding. ATPase work was conducted by Wally Zaugg, NMFS, in the early 1980s and reported in the Proceedings of the N. W. Fish Culture Conference for the fish released in the Cowlitz River.

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

The program attempts to better mimic the natural rearing environment by rearing under natural water temperature.

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

See HGMP sections 5.8, 6.3, 7.9 and 9.1.7.

10 SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1 Proposed fish release levels.

Table 10.1.1: Proposed release levels (maximum number), Cowlitz Salmon Hatchery on-station releases.

Age Class	Max. No.	Size (fpp)	Release Date	Location
Yearlings	2,178,000	15.0	Apr- May	Cowlitz River

Source: WDFW Future Brood Document 2014. Program size may vary from year to year based on credit mechanism.

Note: 15.0 fpp = 146 mm fork length (fl).

Table 10.1.2: Proposed release levels (maximum number) by program, life stage and location, Cowlitz Salmon Hatchery co-operative programs.

Program	Age Class	Max. No.	Size (fpp)	Release Date	Location
Kraus Ryderwood Project	Sub-yearlings	1,000	100	June	Cowlitz River
Various Reg 5 Ed co-ops	Swim-up fry	2,000	1,200-1,500	April	Cowlitz River
Friends of the Cowlitz RSI	Unfed fry	230,000	1,500	March	Cowlitz tribs
Cowlitz Game & Anglers RSI	Unfed fry	40,000	1,500	March	Cowlitz tribs

Source: WDFW Future Brood Document 2014.

Note: 100.0 fpp = 77.5 mm fork length (fl); 1,200 fpp =33.9 mm fl; 1,500 fpp =31.5 mm fl.

With significant numbers of coho adults hauled upstream in previous years, the upper-river plants have been discontinued as long as sufficient natural escapement is available. In past years, surplus fry were released into Swofford Pond; the last release was in 2002.

10.2 Specific location(s) of proposed release(s).

Table 10.2.1: Proposed release locations, by age class.

Age Class	Location			
	Stream	Release Pt (RKm)	Major Watershed	Eco-province
Sub-yearlings	Campbell Creek	*	Cowlitz	Lower Columbia
Yearling	Cowlitz River	78.8	Cowlitz	Lower Columbia
Unfed Fry	Cowlitz tributaries	**	Cowlitz	Lower Columbia

* Campbell Creek (WRIA 26.0443) is a RB tributary to Stillwater Cr (WRIA 26.0429) at RKm. 12.2; RB tributary to Olequa Cr (WRIA 26.0427) at RKm 5.3; RB tributary to the Cowlitz River (WRIA 26.0002) at RKm. 36.4.

** Eyed-eggs are transferred to various Region 5 ed co-ops (school aquariums).

Table 10.2.2: Proposed annual fish release levels (maximum number) by life stage and location, Friends of the Cowlitz RSI programs.

Age Class	Size (fpp)	Max. No.	Release Date	Location		Eco-province
				Stream	Tributary Location	
Swim up fry	1,200 –1,500	8,000	April	Olequa Creek (WRIA 26.0427)	RB tributary to the Cowlitz River at RKm. 40.0	Lower Columbia
		16,000		Lacamas Creek (WRIA 26.0467)	RB tributary to the Cowlitz River at RKm. 44.0	
		16,000		Salmon Creek (WRIA 26.0187)	LB tributary to the Cowlitz River at RKm. 48.6	
		20,000		Bill(ie) Creek (WRIA 26.0518)	RB tributary to the Cowlitz River at RKm. 54.0	

		80,000		Blue Creek (WRIA 26.0527)	RB tributary to the Cowlitz River at RKm. 66.0	
		20,000		Jack Welch Creek (WRIA 26.0531)	RB tributary to the Cowlitz River at RKm. 71.0	
		20,000		Jones Creek (WRIA 26.0531)	RB tributary to the Cowlitz River at RKm. 73.0	
		20,000		McClane Creek (WRIA 26.****)	RB tributary to the Coweeman River	

**** Exact coordinates not available.
Source: Future Brood Document 2014.

Table 10.2.3: Proposed annual fish release levels (maximum number) by life stage and location, Cowlitz Game and Anglers RSI programs.

Age Class	Size (fpp)	Max. No.	Release Date	Location		
				Stream	Tributary Location	Eco-province
Swim up fry	1,200 –1,500	5,000	April	Coweeman River (WRIA 26.002)	Located at RKm 11.2; LB tributary to the Cowlitz River at RKm 1.3.	Lower Columbia
		10,000		Arkansas Creek (WRIA 26.0189)	RB tributary to the Cowlitz River at RKm. 25.5.	
		5,000		Unnamed Trib. (WRIA 26.0128)	LB tributary of the Cowlitz River at RKm. 12.2.	
		5,000		Hill Creek (WRIA 26.0423)	LB tributary to the Cowlitz River at RKm. 35.1.	
		10,000		Campbell Creek (WRIA 26.0443)	RB tributary to Stillwater Cr (WRIA 26.0429); RB tributary to Olequa Cr (WRIA 26.0427); RB tributary to the Cowlitz River at RKm. 36.4.	
		5,000		Salmon Creek (WRIA 26.0479)	LB tributary to the Cowlitz R. at RKm. 48.6	

Source: Future Brood Document 2014.

10.3 Actual numbers and sizes of fish released by age class through the program.

Table 10.3.1: Number of fish, size, CVs and release date, by year, Cowlitz Type-N coho on-station yearlings releases.

Release Year	Segregated Program				Integrated Program			
	Number	Avg Size (fpp)	CV	Date	Number	Avg Size (fpp)	CV	Date
2002	2,967,544	13.4	8.2	Apr 16, May 1				
2003	2,874,425	13.8	6.9	Apr 4-30, May 1-5				
2004	3,138,932	15.1	6.7	May 3				
2005	3,429,570	15.2	6.3	May 2-3				
2006	3,260,568	15.0	6.4	May 1				
2007	3,110,405	14.3	5.4	May 1				
2008	3,446,199	14.5	6.4	Apr 15, 29-30				
2009	2,349,911	14.4	6.67	Apr 29-May 1	472,248	14.3	6.95	Apr 30-May 1
2010	1,970,202	14.6	6.07	May 3-5	938,202	15.1	7.70	Apr 28-30
2011	1,955,779	14.9	7.18	Apr 27-May 2	1,113,507	15.3	7.43	Apr 27-May 2
2012	810,085	14.3	6.71	Apr 27-May 1	1,069,797	14.9	7.58	Apr 27-May 1
2013	1,378,915	14.8	7.46	Apr 27-May 1	996,198	15.1	7.68	Apr 26-May 1
Average	**2,683,715**	**14.4**	**6.74**	-----	**917,990**	**14.9**	**7.47**	-----

Source: WDFW Hatcheries Headquarters Database 2014.
Note: 13.4 fpp = 152 mm fork length (fl); 14.0 fpp = 150 mm fl; 15.0 fpp = 146 mm fl

Table 10.3.2: Cowlitz Salmon Hatchery Type-N coho sub-yearlings transferred to Kraus Ryderwood project.

Brood Year	Transfer Date	Average Size (fpp)
2005	Jul 18, 2006	73
2006	Jul 11, 2007	83
2007	Jul 28, 2008	80
2008	Aug 14, 2009	92
2009	Jul 13, 2010	83
2010	Jul 26, 2011	74
2011	Jul 16, 2012	80
2012	Jul 30, 2013	57

Source: WDFW Hatcheries Headquarters Database 2014.

Table 10.3.3: Numbers released, date, and average size, Friends of the Cowlitz Coho RSI project.

Release Year	Unfed Fry		
	No. Released	Date	Avg Size (fpp)
2003	240,500	Mar 9-11	901
2004	180,000	Mar 15-20	1,500
2005	NA	NA	NA
2006	NA	NA	NA
2007	NA	NA	NA
2008	194,100	Mar 2-21	1,500
2009	194,100	Mar 16-26	1,500
2010	227,900	Mar 16-30	1,500
2011	227,700	Mar 11-28, Apr 23	1,500
2012	225,500	Mar 12, 20-30. Apr 9-11	1,500

Source: WDFW Hatcheries Headquarters Database 2014.
NA – Data not available

Table 10.3.4: Numbers released, date, and average size, Cowlitz Game and Anglers Coho RSI project.

Release Year	Unfed Fry		
	No. Released	Date	Avg Size (fpp)
2003	NA	NA	NA
2004	NA	NA	NA
2005	NA	NA	NA
2006	NA	NA	NA
2007	NA	NA	NA
2008	40,000	Mar 20	1,500
2009	NA	NA	NA
2010	NA	NA	NA
2011	NA	NA	NA
2012	40,000	Jan 1-30	1,500

Source: WDFW Hatcheries Headquarters Database 2014.
NA – Data not available

10.4 Actual dates of release and description of release protocols.

Cowlitz Salmon Hatchery: Coho are released from the concrete raceways, which leads to a volitional release pipe entering the Cowlitz River below the Barrier Dam. The Barrier Dam has

an electrical field that is used to discourage adult passage over the Barrier Dam during upstream migration of adults See **Table 10.3.1** for actual release dates.

FOC and CG&A RSI projects: See **Table 10.3.3** and **Table 10.3.4** for observed release dates. Fry egress volitionally from the RSIs starting in mid-March and have finished by early-April, depending on individual tributary environmental conditions. If they are confined in stack trays, staff would have to visually inspect that most fry swimming fry have buttoned up and manually release each tray to the stream. Studies on coho emergence from RSIs indicate that coho fry move upstream and downstream with fry found more than 500-m upstream in some systems by June (WDOT, 2002).

10.5 Fish transportation procedures, if applicable.

Several small tankers with air stones (one 750 gallon, one 1,000 gallon and several 250 gallon tanks) are utilized for moving fish or fry around the facility.

10.6 Acclimation procedures (methods applied and length of time).

On-station releases. Yearling fish are acclimated on Cowlitz River water during their entire rearing time at the hatchery.

Cowlitz Falls releases. Fish transferred from the Cowlitz Falls facility are held for a day in the stress relief ponds before release to the Cowlitz River.

Upper Cowlitz releases. River water temperatures is measured to ensure that fish are released within 7°F of the water in which they were transported. If the transport water temperature is greater than 7°F, some of the water removed from the tank and river water is pumped and circulated through the tank for approximately 15 to 30 minutes, or until the tank water has reached the target temperature.

FOC and CG&A RSI projects: Fish incubate and rear on-site.

10.7 Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Table 10.7.1: Releases and marks applied.

Age Class	Max. No.	Size (fpp)	Release Date	Marks
Yearlings	1,200,000 (seg)	15.0	Apr- May	Ad Only
Yearlings	978,000(integ.)	15.0	Apr- May	Ad + CWT

Source: FBD 2014.

FOC and CG&A RSI projects: Unfed fry are released unmarked.

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Cowlitz Salmon Hatchery: Without fry needed for upriver plants, the egg take goal has been reduced to reflect only what is needed for the hatchery yearling portion and approximately 270,000 eyed eggs needed for cooperative projects in the area. The program guidelines for annual broodstock/egg-take collection are managed to prevent any surpluses, and maintained within the ±5% guideline. In the event of surplus >10%, WDFW Regional Managers will in accordance with regional policy and guidelines set forth in management plans/agreements and ESA permits, and after consultation with NMFS, instruct hatchery staff for disposition of the surplus.

FOC and CG&A RSI projects: No surplus at the time of release. Eggs are allocated to each site upon delivery.

10.9 Fish health certification procedures applied pre-release.

Cowlitz Salmon Hatchery: Adult salmon are routinely sampled for IHNV. BCWD is monitored by the Fish Health Specialist and by lowering rearing densities and increasing raceway flows it has been minimized with infrequent need to treat with antibiotics. Prior to release, population health and condition is established by the Cowlitz Complex Fish Health Specialist. This is commonly done 1-3 weeks pre-release. Prior to this exam, whenever abnormal behavior or mortality is observed, staff also contacts the Cowlitz Complex Fish Health Specialist. The fish health specialist examines affected fish, and recommends the appropriate treatment. Reporting and control of selected fish pathogens are done in accordance with the Co-managers Fish Disease Control Policy and IHOT guidelines.

FOC and CG&A RSI projects: No fish health inspection takes place, as unfed fry are released as soon as they are buttoned-up.

10.10 Emergency release procedures in response to flooding or water system failure.

Cowlitz Salmon Hatchery: In event of system failure, there is an extensive alarm system capable of identifying problems in critical areas of the hatchery. At the stress relief ponds a diversion valve has been added to the ponds to divert water from the aeration stacks directly into the ponds.

FOC and CG&A RSI projects: During eyed egg stage, eggs can be kept moist without water if needed for a considerable periods of time. If fry are mostly free-swimming, fish can be released.

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

Cowlitz Salmon Hatchery:

- Releases are consistent with past history indicating the time, size and conditional release of smolts for migration fitness and smoltification occurs within nearly the entire population, which reduces residence time in the river after release.
- Physiological measures, including allowable population fork length standard deviation (STD) and coefficient of variation (CV) maximums, will be used to monitor growth and population variations.
- Fish are acclimated for approximately 12 months at the site before release.
- Innovative rearing techniques proposed in the settlement hatchery remodel may incorporate semi natural aspects of fish culture including protective pond coloration along with overhead and in-water cover on an experimental basis.
- Mimicking the size and timing for natural out-migrants may be attempted.

FOC and CG&A RSI projects:
Size of fry emigrating from the RSIs mimic the natural population of coho and do not have a competitive advantage.

11 SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1 Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

Table 11.1.1 is from the FHMP udate Appendix J - Monitoring and Evaluation Plan: Analytical Methods and Monitoring Activities of the FHMP, see attached Appendix J for additional information on specific monitoring activities.

Table 11.1.1: Monitoring activities that will provide the data (measure) that support the analysis for one or more populations in the project area.

Code	Name/Description	Analytical Methods Supported	Application (Populations)
MA-A	Carcass/Redd Surveys	AM-1, AM-2	LC: FCH, COH, STHD
MA-B	Juvenile Trapping	AM-1, AM-9, AM-10, AM-14	LC: FCH, COH, STHD, CUT
MA-C	Creel Survey	AM-4, AM-5	All Populations
MA-D	Catch Record Cards	AM-3, AM-4, AM-5, AM-11	LC: FCH, COH, STHD, SPC
MA-E	Hatchery Brood Bio-sampling	AM-6	LC: FCH, COH, STHD, SPC UC: COH, SPC
MA-F	In-hatchery Monitoring	AM-7	All hatchery programs
MA-G	Juveniles at Cowlitz Falls	AM-12	UC: COH, STHD, SPC, FCH
MA-H	Juveniles at Mayfield	AM-13	TIL: COH, STHD, SPC
MA-I	Adults at Separator	AM-11	UC: COH, STHD, SPC, FCH TIL: COH, STHD, SPC
MA-J	Weir Operation	AM-1b	LC: COH, STHD

Data Source: FHMP 2011 – Appendix J 2014.

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

See HGMP section 11.1

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

The Bonneville Power Administration (BPA) funds the evaluation of productivity of Chinook, late winter steelhead, coho and cutthroat trout in the upper Cowlitz River basins. Tacoma Power and WDFW fund the lower Cowlitz River monitoring programs.

11.2 Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Monitoring activities follow scientific protocol in handling listed fish. Smolts handled for data collection such as condition factor, length and weight are anesthetized with MS – 222 and placed in recovery tanks before hauling. At the salmon hatchery separation facility, adults can be transferred via water to water in the tanker truck fish to minimize stress.

12 SECTION 12. RESEARCH

12.1 Objective or purpose.

No research is directly associated with the program.

12.2 Cooperating and funding agencies.

Any research is conducted by WDFW and funded through Tacoma Power.

12.3 Principle investigator or project supervisor and staff.

Bryce Glaser (WDFW) and Mark LaRiviere (Tacoma Power)

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Not applicable.

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

Not applicable.

12.6 Dates or time period in which research activity occurs.

Not applicable.

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

Not applicable.

12.8 Expected type and effects of take and potential for injury or mortality.

Not applicable.

12.9 Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

Not applicable.

12.10 Alternative methods to achieve project objectives.

Not applicable.

12.11 List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Not applicable.

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

Not applicable.

13 SECTION 13. ATTACHMENTS AND CITATIONS

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Attachment 1: WDFW Virology Sampling 2008-2009 through 2012-2013: Cowlitz Hatchery Complex coho.

Source: WDFW Fish Health Lab data 2014 (John Kerwin)
Note: For Cowlitz system Chinook, steelhead and cutthroat data, see respective Cowlitz HGMPs.

Hatchery/ Collection site	Stock	Species	Date Sampled	Results	Comments	Life Stage	Sample number	NUMBER OF SAMPLES						CELL LINE	ID	FRZ DATE	INOC DATE
								OF	POOL	K/S	POOL	fry/visc/other	POOLS				
COWLITZ S	COWLITZ R	NCOHO	12/02/09	NEV		AD	1203-1/2	60	12	60	12						
COWLITZ S	COWLITZ R	NCOHO	12/02/09	NEV		AD	1203-1/2	60	12	60	12						
COWLITZ S	COWLITZ R	NCOHO	12/07/10	NEV		AD	1208-8/9	45	9	45	9						
COWLITZ S	COWLITZ R	NCOHO	12/20/10	NEV		AD	1220-3/4	15	3	15	3						
COWLITZ S	COWLITZ R/H	NCOHO	12/13/11	NEV		AD	1214-1/2	30	6	30	6						
COWLITZ S	COWLITZ R/W	NCOHO	12/13/11	NEV		AD	1214-3/4	30	6	30	6						
COWLITZ S	COWLITZ R	NCOHO	11/28/12	NEV		AD	1128-13/14	60	12	60	12						

14 SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

15 ADDENDUM A. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS. (Anadromous salmonid effects are addressed in Section 2).

15.1 List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.

The WDFW and the USFWS have a Cooperative Agreement pursuant to section 6(c) of the Endangered Species Act that covers the majority of the WDFW actions, including hatchery operations.

> "The department is authorized by the USFWS for certain activities that may result in the take of bull trout, including salmon/steelhead hatchery broodstocking, hatchery monitoring and evaluation activities and conservation activities such as adult traps, juvenile monitoring, spawning ground surveys..."

15.2 Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

Several USFWS listed and candidate species are found in Lewis County, however the hatchery operations and facilities for this program do not fall within the critical habitat for any of these species. As such there are no effects anticipated for these species.

Listed or candidate species:
"No effect" for the following species:

Bull trout (*Salvelinus confluentus*) – Threatened (Critical Habitat Designated)
Nelson's checker-mallow (*Sidalcea nelsoniana*) –Threatened
Marbled murrelet (*Brachyramphus marmoratus*) –Threatened (Critical Habitat Designated)
Columbian White-Tailed deer (*Odocoileus virginianus leucurus*) – Endangered
Gray Wolf (*Canis lupus*) –Threatened
Northern Spotted owl (*Strix occidentalis caurina*) –Threatened (Critical Habitat Designated)

Candidate Species
North American wolverine *(Gulo gulo luteus)* – contiguous U.S. DPS

15.3 Analyze effects.

Not applicable.

15.4 Actions taken to minimize potential effects.

Program steelhead are released fully smolted to foster rapid outmigration from the basin and to minimize predation and residualism risks.

15.5 References

Not applicable.

16 "Take" Tables

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Chinook (*Oncorhynchus tshawytscha*) Steelhead *(Oncorhynchus mykiss*) Coho (*Oncorhynchus kisutch*) Chum (*Oncorhynchus keta*)	**ESU/Population:** Lower Columbia River Chinook Lower Columbia River Steelhead Lower Columbia River Coho Columbia River Chum	**Activity:** Cowlitz Type-N coho program
Location of hatchery activity: Cowlitz Salmon Hatchery, Cowlitz River at RKm 78.8	**Dates of activity:** September-March	**Hatchery program operator:** WDFW

Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass	TBD	TBD	TBD	TBD
Collect for transport	TBD	TBD	TBD	TBD
Capture, handle, and release	TBD	TBD	TBD	TBD
Capture, handle, tag/mark/tissue sample, and release	TBD	TBD	TBD	TBD
Removal (e.g. broodstock)	TBD	TBD	TBD	TBD
Intentional lethal take	TBD	TBD	TBD	TBD
Unintentional lethal take	TBD	TBD	TBD	TBD
Observe or harass	TBD	TBD	TBD	TBD

Take Table to be submitted to NOAA-NMFS, in progress. Will include monitoring activities.